THE VICTORY OF TELEVISION

—

PHILIP KERBY

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Photo by Haussler, NBC.

TELEVISION'S VITAL ELEMENTS

The "eye" of the electronic system of television is the iconoscope, which translates the lights and darks of the image into electrical impulses. These in turn are broadcast and reproduced on the fluorescent screen of the kinescope. The ultra-sensitive microphone transmits sound, as in ordinary broadcasting.

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BY

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HARPER & BROTHERS PUBLISHERS
NEW YORK AND LONDON
1939

THE VICTORY OF TELEVISION

PRINTED IN THE UNITED STATES OF AMERICA

FIRST EDITION

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To

F. C. P.

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PREFACE

EVERY new invention wears a cloak of mystery, interwoven with gossip, rumor and half-truths. To strip off this cloak and present television, victorious in its own right, is the aim of this volume. The results achieved in fighting through the black years for television's development have more than compensated for the heartaches and temporary setbacks experienced by the greatest men of science on two continents.

During the past quarter-century many learned books and papers on the progress of television have been prepared by scientists for scientists on both sides of the Atlantic. Filled with mathematical computations, formulae, and abstruse arguments all essential for the understanding of a highly complex subject, these books were not written for the general public. Eighty percent of television's success or failure depends on the public's attitude toward it.

On the following pages a sincere endeavor has been made to report exactly what television is, what it does, and what it may do. In the rapidly moving kaleidoscope of progress, few dare to predict exactly what the future holds for this newest of the arts. From

experience obtained through witnessing the development of both motion pictures and radio we recognize that today's television, which borrows the best from both of these arts as well as from the legitime stage will undoubtedly seem as crude a decade hence as the first televised moving silhouettes would seem today. Keeping in mind that we are present at the birth of a new system of communication as well as that of a new art, the writer asks indulgence for omissions and commissions in the following simple report of how science spans new horizons with sight and sound.

P. K.

New York City
September 26, 1939.

THE VICTORY OF TELEVISION

I. EARLY INVENTIONS

TELEVISION is new, exciting, glamorous.

Although combining the entertainment values of movies and radio, it stirs the imagination as few other inventions of our day because it provides accurate close-ups of history in the making. Two thousand years ago, a mighty Stentor in the Roman Forum called:

"Lend me your ears!"

Today the eyes as well as the ears are lent, and no Stentor is required to report contemporary events because television brings them to us even as they are transpiring. Anything that can be seen and heard can be televised.

To marry sight with sound and transport both across invisible waves of ether with the speed of light has been man's greatest dream since throbbing drums and smoke spirals communicated the Aborigines' war commands through space. Television is the practical fulfillment of that dream—and television today is an accomplished fact.

Every modern invention can be attributed to one

man or to a small group of men working in unison—that is, every modern invention except television. It is the composite product of many minds, during many years, working along the same lines, in many countries. Back in 1600 William Gilbert propounded his revolutionary theory that the earth itself was an enormous magnet possessing magnetic poles and whirling in a field of force. Practically every electrical invention since has contributed in greater or less degree to the birth of television. Luigi Galvani's discovery of the so-called galvanic electricity in 1780 and Allesandro Volta's invention of the voltaic cell fourteen years later were two of television's distant progenitors, just as was Michael Faraday's discovery of the laws of electro-magnetic induction in 1831. Although Berzelius, a Swedish pharmacist, is credited with having isolated a substance in 1817 which he called selenium, over a half-century elapsed before the unusual properties of selenium were either understood or employed for the advancement of human knowledge. In 1873 an inquisitive Irish lad named May put selenium to work.

May was a telegrapher employed in the trans-Atlantic cable station in Valentia in the southwest of Ireland. When not engaged at his long trick at the key flashing messages back and forth between North America and Ireland over the newly laid cable, May busied himself with inventions to improve the strength of the signal. After experimenting with resistors

made of many different types of materials, May found to his complete amazement that a resistor made of selenium transmitted electrical impulses far better when exposed to sunlight than when it was kept in the dark. British and European scientists conducted a series of exhaustive tests which confirmed May's experiments. The discovery of the effect of sunlight on selenium later became the key to the riddle of how to convert light waves into electrical impulses. This paved the way for the discovery of the modern photo-electric cell, a principle which eventually became the heart of modern electronic television. During the 1880's and early 1890's various fantastic theories were advanced for "Seeing by telegraph."

In America G. R. Carey was experimenting with ways to send pictures along a wire. In England Perry and Ayrton had another method of transmitting images electrically. In 1881 Shelford Bidwell read a paper before the Physical Society of England and illustrated his lecture by sending actual outlines across a wire. But the most important discovery was made by Paul Nipkow who patented a device whereby separation of various color values could be made by employing a rotating disc. Although crude this proved the fundamental principle that light and dark could be separated mechanically. Nipkow's disc had a series of small holes in the form of a spiral which permitted light to penetrate and scan the subject through

each one of the holes in succession and thus form a series of lines.

While men of science were deeply embroiled in considering how best to transmit a single picture over a wire, in France, Maurice LeBlanc, who many regard as the father of moving pictures, added further complications to the controversy, by asking: "How are you going to show motion?"

This was a step beyond any preconceived ideas, for up to that time all efforts had been bent toward the transmission of a single image. LeBlanc answered his own question by stating the theory that it would be necessary to dissect a moving object into a series of pictures which, if projected in a predetermined sequence, would fool the eye into believing it was actually seeing motion. The success of this optical illusion depended, of course, on the perfect timing in the transmission of pictures and, more important still, their reception in exactly the same sequence in which they were sent. In other words, LeBlanc merely restated his fundamental theory of the cinematograph. Instead of flashing these pictures on a tape before a magic lantern light to project them on a screen, LeBlanc now proposed to transmit them electrically across a telegraph wire. Twin mirrors were advanced by LeBlanc as his contribution toward solving the problem of mechanical scanning. He proposed that the mirrors should vibrate at different speeds, slow for vertical and fast for horizontal. Transmitting an image

over the wire by separating the darks from the lights and attributing a separate electrical value to each, still remained to be dealt with.

At this point it is perhaps well to digress a moment and take a look at some other inventions which were taking place and which had a direct bearing on television transmission. At Cambridge University in 1864 the existence of electro-magnetic waves was reported. In 1888, Heinrich Hertz, a noted German scientist, actually produced and measured these waves, which were called Hertzian waves in honor of their discoverer. They could be sent through space at the same speed as light.

These same Hertzian waves enabled a youthful Italian inventor, Guglielmo Marconi, to send and receive the first wireless signals across his father's estate at Bologna in 1895. So much has been written about this Italian wizard and the debt that civilization owes him for his untiring efforts to perfect a better system of communication for his fellow men that any further discussion is redundant. Following his first successful wireless experiments in Italy, he went to London, and in 1900 was issued his famous patent, No. 7777, covering a tuned wireless system.

The following year accompanied by three assistants Marconi traveled to Newfoundland. After months of painstaking preparation, long nights of weary vigil, followed by periods of black despair, Marconi's greatest victory came when he heard the letter

"S" crackle across the storm tossed waters of the North Atlantic from the sending station at Poldhu, England.

To return once again to our scanning and receiving problems, comparatively small advances were made until about the beginning of the twentieth century when Karl Braun of Germany discovered a means for showing visually the variations of alternating current in a vacuum tube. He named his tube the oscilloscope. The existence of both anode and cathode rays had been known for some years. More than twenty-five years previously the eminent British scientist Sir William Crookes perfected the Crookes Tube which isolated the principle of the cathode ray operating in a vacuum. Braun developed the theory that the fluorescent spot could be made sharper and clearer by placing a magnetic field from a coil around the tube. Since the same power that produced the cathode ray also produced the spot of light at the end of the tube, it naturally followed that the light beam could be deflected by the same means.

The Braun tube immediately assumed an important place in medical therapeutics. In Russia a scientist named Boris Rosing added a new chapter to television. In experimenting with the Braun tube he discovered that scanning the fluorescent surface at the end of the tube would instantaneously re-create the original image at the receiver.

In 1911 at a meeting of the Roentgen Society in

England, Campbell Swinton reviewed all the progress in television to that date and predicted that future progress would be along electronic lines with the use of cathode-ray tubes and that mechanical scanning devices would eventually be supplanted with "scanners" operated automatically by electricity. The question naturally arises why did it take twenty-five years before Campbell Swinton's prophecies were fulfilled?

The fundamental reason is that although television and radio were developing side by side, radio, or wireless as it was called in those days, was a new system of communication that daily was proving its worth in many unusual ways. In 1909 Jack Binns, intrepid wireless operator, had flashed his famous "C.Q.D." (Help!) from the antenna of the S.S. *Republic* after colliding with the S.S. *Florida.* In subsequent messages he directed rescuing ships to the *Republic's* position and thus wireless, for the first time, was used to save the lives of passengers and crew. This dramatic rescue gave it a tremendous impetus. Sweeping legislation was initiated in Europe and America requiring all passenger ships over a certain tonnage to install wireless equipment.

Three years later when the R.M.S. *Titanic* hit an iceberg on her maiden voyage, the wireless again proved its value a thousandfold. It summoned rescue ships and also relieved an anxious world by sending lists of those saved, dead and missing. It told, as well,

a saga of the sea which for bravery and sacrifice has had few equals.

During the years preceding the World War, radio's progress far outstripped that of television, primarily because radio had proved its necessity for communications.

All research in television throughout the world was halted by the World War. Those electrical scientists who did not wear the insignia of the Signal Corps on their tunics were drafted into the great industrial laboratories for consultation and advice on the production of war material.

The war, however, proved a great stimulus to original invention and research because both funds and facilities were appropriated with a lavish hand. The so-called "mud wireless" came out of this research. After a heavy bombardment or rapid advance it was the only means of communication available between the front lines and headquarters in the rear. As we look back on them today these diminutive hand sets seem crude in the extreme, but for all their crudeness they still sputtered code when all else failed.

Without the research carried on as a measure of war necessity the dramatic birth of voice radio would probably have been delayed many years. In these days television was a stepchild. Neither Campbell Swinton nor any of his contemporaries could work out practical application of their theories. They could

find no way to increase the signal strength after an image had been televised. In other words, although an image might be scanned, the problem immediately arose of how to strengthen the weak impulses generated in the scanning device used for registering the televised object.

Following the war, when scientists again resumed intensive television research, American scientists took the lead. Mineralogists and chemists working in cooperation discovered several substances of far greater sensitivity to light than selenium and these materials found an immediate use in the highly perfected photo-electric cells.

Dr. Lee de Forest had discovered the three-electrode vacuum tube for use in radio. The television researchers found these tubes were highly effective in boosting the power of the electric impulses generated by the mechanical scanner. Newspapers in London and New York reported at length the result of these experiments in mechanical scanning. There was a distinct flurry of excitement about television in Europe and America. C. F. Jenkins held a public demonstration in Washington which was hailed an outstanding success. In England, John L. Baird, an Englishman, presented his mechanical scanner before a distinguished gathering of the Royal Institution in London. Although Baird's scanning was at the rate of thirty lines a picture and twelve and a half pictures a second there was necessarily a distinct flicker

in the image, because it was projected only half as fast as the ordinary motion picture film. Scientists of the Bell Telephone Laboratories created another sensation by transmitting sight synchronized with sound over a telephone wire from Washington, D. C., to New York City. They also demonstrated the possibility of sending television by ultra-high frequency carrier waves over a much shorter distance. Baird spanned the Atlantic in 1928 with a low definition picture.

During the piping times of prosperity in the era of the Golden Twenties there was abundant capital available to promote the progress of television. Several optimistic newspapers predicted that "Television was right around the corner." These editors, however, reckoned without their host.

Television's twin—sound radio—had advanced by leaps and bounds during the intervening years. An economic problem arose in the mind of broadcasters, as to whether greater profits would accrue from sponsoring television, which although more glamorous was still an unknown, or to continue the promotion of radio through coast-to-coast networks. Radio won for the very obvious reason that it was a proved money maker and capital investment in stations, studios and stars was too great to jeopardize by the sponsoring of a new and untried form of entertainment. Since the advent of talking motion pictures, television had

to attain doubly high standards in order to compete with them on anything approximating an even basis.

Although scanning was increased from the original thirty lines to two hundred and forty lines a picture and the number of pictures was increased from twelve and one-half to twenty pictures a second, no television presentation of that period could compare with the cinema production on a basis of competitive entertainment. Television pictures at this time had insufficient clarity of outline and much too much flicker. Many research workers believed that mechanical scanning had reached its limit with two hundred and forty lines a picture, and so executives of the great industrial laboratories directed their attention toward the development of a totally new system. Stated differently this was a return to the theories enunciated by Campbell Swinton in 1911. Electronic scanning appeared to be the only means for developing a higher rate of speed to approach the definition of the subject comparable to motion pictures.

II. TELEVISION COMES OF AGE

With two notable exceptions, every recent invention in America contributing to the progress of television has been made either by an individual or a group working within industrial laboratories maintained by great corporations. The exceptions include a lanky midwestern youth, and a mature Russian scientist.

Philo T. Farnsworth, the youth, astounded his high-school professors by solving easily the most difficult mathematical problems. While still in his teens, he produced a workable television electronic scanner, which he later called the "Image Dissector." During the past ten years his meteoric rise from an unknown "Kid Inventor," to the vice-presidency of a $6,000,-000 corporation which bears his name and holds several important patents reads like one of Horatio Alger's stories come true to life.

It would take the descriptive pen of a Tolstoy to do justice to the brilliant career of Dr. Vladimir F. Zworykin, a refugee from the land of the Czars, whose contributions to the advancement of human knowledge about television have encircled the world. It is

said that he worked out the preliminary details of his famous iconoscope, the "eye" of the television camera, with Russian compatriots in Greenwich Village. Westinghouse recognized his unusual talents and gave him a position in their department of original research. While he was working for Westinghouse, he took out his first patent on the iconoscope. Ten years of constant concentration by Dr. Zworykin and his assistants were required to develop the iconoscope to its present high state of efficiency. During that decade several things happened, among which was that Dr. Zworykin left Westinghouse and joined the Radio Corporation of America, and his subsequent patents on the improved iconoscope were taken out by RCA.

Past experience with television has shown conclusively that the only constant thing is change, hence any description of how television operates must first be tempered with caution. It appears to be impossible to be didactic about any new art or science. Greater speed in scanning, generally speaking, provides greater definition of the image, so many scientists believe that electronic scanning will eventually supplant all other means of telecasting. Subsequent improvements, new theories, or even radical new discoveries may result in a complete change in telecasting technique, but this seems quite remote at the present writing. All-electronic scanning is the method

used by every American company broadcasting television programs.

Television, as far as public presentations are concerned, is still so young that the Federal Communications Commission, which has complete charge of the regulation of all matter pertaining to the transmission or reception of messages by mechanical means (telephone, telegraph, radio, and now television), has yet to formulate official universal rules on standard practice for the industry. Following a meeting of the Radio Manufacturers Association in the early fall of 1938 tentative specifications were adopted.

Of equal importance with the iconoscope for electronic scanning is the kinescope. The iconoscope is the "eye" of the television camera and the kinescope is the screen upon which the picture appears. In other words, the kinescope is the improved cathode-ray tube which receives the televised image and reflects it on a highly polished mirror from which it is viewed. Mass production of these delicate tubes of the iconoscope and kinescope have required the utmost skill and precision workmanship.

Everyone is familiar with the telephone transmitter. You speak into it and your voice is heard at the receiver at the other end. Many of us, however, have never stopped to think that voices cannot go over the wire as actual sounds but must first be translated into a series of tiny electric impulses, a separate one for each modulation or tone. This process of translation

of sound into electric impulses was carried a step further with the supersensitive, streamlined microphone of radio. In it the tiniest whisper can be magnified, broadcast without the aid of wires, then picked up and unscrambled by the receiving set. Television, however, employing the dual functions of sight and sound had to translate both into electric impulses and then synchronize the transmission of each so accurately that both would be received simultaneously. In the foregoing chapter we have seen how man struggled through several generations before discovering a method whereby lights and darks could be successfully translated into electric impulses and then transmitted either over a wire or broadcast through the air.

Anyone who has ever snapped the shutter of a camera, whether a Brownie or super-speed Leica, knows that—barring unforeseen accidents—he will get on the film the exact scene in front of the lens. The film or glass plate which has previously been chemically sensitized to light will be developed and the picture will appear. Up to a certain point the same process holds true of a television camera, only instead of a glass plate or film the camera's high-speed lens projects the scene on a special metal plate mounted within the bulbous end of the iconoscope. When exposed to light this small metal plate generates tiny charges of electricity, similar to the light meter used by amateur photographers to determine the intensity of light and regulate the camera shutter opening

accordingly. In the light meter the needle fluctuates in accordance with the amount of Galvanic electricity generated by the brightness or the dimness of the light.

While the sensitized metal plate of the iconoscope gives a general over-all indication of the brightness or dimness of the scene to be televised, it does not and cannot portray any of the details. The problem must then be solved how best to dissect the scene so that each gradation of dark and light may be accorded its proper value. But this is not all. Each of these values must be translated into a corresponding electrical impulse and transmitted in the proper order that they may be reassembled in exactly the same sequence. Unless this order is followed no picture would be produced.

It is as if one had a large and complicated jig-saw puzzle of 441 pieces. Let us say, for some reason you want that puzzle on the other side of the room, but instead of carrying it across, you hurl it over piece by piece. Let us suppose further that your aim is so unbelievably accurate that each of the 441 pieces will fall exactly into its proper place so that the whole puzzle will be put together again without a single piece left over or missing. Now stretch your imagination to the breaking point and try to conceive of throwing and reassembling thirty jig-saw puzzles composed of 441 pieces each, every second. The normal brain refuses to take in such an utterly fantastic im-

probability, and yet this man-made miracle is accomplished by the iconoscope.

The great LeBlanc demanded smooth flowing action for his cinematograph and the iconoscope is the answer of modern science to this demand. Pictures pour so rapidly from it that when seen in the mirror above the kinescope the eye is completely fooled because the characters actually seem to be moving about and carrying on conversation, an illusion which is further heightened by the synchronized voices of the radio.

As previously stated, when the reflection of the image is transmitted through the properly focused lens of the television camera, it falls on the light-sensitive plate which is a mosaic of thousands upon thousands of photosensitized pinheads of silver. When light hits each individual one of these pinheads it becomes charged positively in proportion to the amount of light reaching it. These positive charges are held by the photo-electric cell pinheads until removed by the scanning beam passing across the plate. The image is scanned so rapidly that it is almost impossible for the human mind to imagine such speed.

In the long tube of the iconoscope are infinitesimal pulses of negative electricity called electrons. Operated automatically by independent magnets, these electrons are shot across the plate from left to right and from top to bottom at the predetermined speed of two miles a second. On the return trip the electron beam travels ten times as fast, or twenty miles a sec-

ond. The beam scans the 441 lines of any image in approximately one-thirtieth of a second. As a matter of cold fact, the beam actually scans the picture twice in one-thirtieth of a second because it scans the 220 odd lines first and then returns and scans the 221 even lines. Far greater clarity is made possible through this type of "interlaced" scanning. The tremendous speed is necessary to transmit action pictures.

Reception of a televised image is exactly the opposite of television transmission. After the lights and darks have been converted into their corresponding electrical impulses through the magic of iconoscope scanning they are amplified through vacuum tubes and then broadcast over ultra-high frequency or "short" waves.

As previously mentioned the kinescope is the "heart" of the television receiver. It consists of an elongated cathode-ray vacuum tube with a hollow glass mushroom at one end. The underside or flat surface of the mushroom is coated with zinc-sulphide, or other light-sensitive chemical which glows when electrons are shot at it. Operating in complete synchronization with the scanning beam of the iconoscope, the beam of electrons in the kinescope re-creates the identical image on the kinescope's fluorescent screen. These two scanning beams must maintain an absolute "lock-step" because if they deviate as much as a hundredth part of a second the

image becomes fuzzy and the illusion of motion is lost.

This question of televising motion brings up another important problem, namely the wide range of electrical frequencies necessary to televise accurately the continually shifting lights and darks of any image. Most of us are reasonably familiar with the radio or wire photographs transmitted from coast to coast, or across the ocean and published in the newspaper the same time as the telegraphed account. When science had reached the point of relaying these pictures through the air at the phenomenal rate of one completed picture every ten or twelve minutes, the world marveled. The very fact that these photographs can be transmitted over an ordinary telegraph, telephone, or transatlantic cable wire indicates that they are sent at a comparatively slow speed, because the outside capacity of these wires is somewhere between 10,000 to 15,000 cycles a second. Television on the other hand, because of the speed of the scanning of the image, plus the fact that thirty images or pictures are televised every second requires an infinitely greater range of frequencies than that required for the transmission of a "still" photograph. In other words television broadcasts need a potential range up to 3,500,000 cycles a second in order to transmit thirty images with a clarity at all comparable to motion pictures.

Someone may well ask the question at this point what are frequencies and why does television need

such wider bands of frequencies, than, for example, sound radio?

During the past half-century there have been many books in many languages written on the subject of electrical frequencies, their origin, development and contribution to modern electrical science. Without recourse to technicalities or mathematical formulae, frequencies are, broadly speaking, the units of measure of electrical wave bands. Just as the number of physical vibrations can be measured in every sound (middle "C" has 128 vibrations a second), so every electrical impulse generated can be measured in terms of frequencies. Because television requires such wide bands on the frequency spectrum, programs can be broadcast only on ultra-high frequencies or short-wave bands, otherwise the stations would interfere with each other.

The Federal Communications Commission has ten bands, composed of nineteen channels for allocation to the television broadcasting companies. As soon as network television becomes practical, each one of these channels will be allocated to an individual station.

The present inability to telecast over a national network is one of the greatest drawbacks of television. Through the years radio listeners have become accustomed to tuning in coast-to-coast networks for their big shows. The reason why nation-wide television programs are not possible at present goes back to the

nature of the ultra-short waves themselves. These ultra-high frequency waves have been subjected to the most rigorous research and exhaustive tests during recent years, but much still remains to be learned about their characteristics. This much, however, is definite and certain. Short waves, unlike their longer commercial cousins used as carriers for sound broadcasting, have a habit of going in a straight line to the horizon and then off into space still following the same course. Commercial waves follow the curvature of the earth.

Coast-to-coast radio programs are usually broadcast from 90 to 100 stations simultaneously. These stations are linked together by ordinary telephone, and the program "rides the wires" from its point of origin to the individual station where it is put on the air. Because sound broadcasting uses only approximately 5,000 to 10,000 cycles a second the ordinary telephone wire can carry it easily. Television requires 3,500,000 cycles a second so no single wire could carry the load.

There are two alternatives, each one of which might solve the problem of simultaneous telecasts of national programs. Some three years ago scientists of the Bell Telephone Research Laboratory announced the development of the coaxial cable. Although developed primarily for carrying large numbers of telephone conversations simultaneously, experiments proved that it could carry television broadcasts with

comparatively small loss. The only stumbling block was the cost which is prohibitive. To lay a coaxial cable from coast to coast with some 90 or 100 outlets would cost $100,000,000, a capital expenditure which no telecasting company is prepared to underwrite at the present time. The other alternative is through the automatic radio relay, or "booster" stations. These could be located approximately every twenty miles from horizon to horizon.

The possibility of using booster stations for television national networks was only envisioned recently when a new method of broadcasting the television signal was announced. According to this discovery television may be broadcast along a directional beam with comparatively small losses due to the diffusion of the signal. It is then picked up by the automatic radio relay and rebroadcast with only a comparatively small loss of power or clarity. Because these radio relay stations are automatic they can be operated much less expensively than laying a coaxial cable. This problem of telecasting nationally is absorbing the thought of the greatest electrical scientists in the country and everything possible is being done to speed the day when network television programs will be a reality.

III. EYE VIEW OF MODERN TELEVISION STUDIO

Television is broadcast from a studio that is a cross between a hospital operating pavilion and a Hollywood motion picture set. While a program is on the air one feels the hush that comes over an operating room during a major operation. This feeling of suppressed excitement is made all the more intense by the sign language employed by the director. He gives the cues and directions to his actors in much the same manner as a surgeon motions to his assistant to hand him the proper instruments. There is also the brisk business-like air of a well run hospital with everyone concentrating upon his particular job and doing it as quickly and as silently as possible.

The strong resemblance to one of Hollywood's more efficient studios begins with the almost blinding illumination afforded by the high wattage lamps. There is a battery of three television cameras mounted on silent rubber tired dollies, bits of scenery, flats, tormentors, innumerable props, adjustable spotlights, and costumes laid out in readiness for lightning changes.

The enormous studio of the Columbia Broadcasting System is located on an upper floor of the Grand Central Terminal Building in New York City. It is a city block long, sixty feet wide and forty-five feet high. Across one end has been built the sound-proof control room. When the Columbia studio was first opened considerable difficulty was experienced with echoes which caused booming reverberations against the ceiling and the walls, one of which is composed of three enormous semicircular windows. This was finally overcome by building compact studio sets. In each set was stretched a false ceiling of heavy cloth, and this cloth was also tacked against the walls from the ceiling to the floor. Felt covering on the floor deadened the sound of footsteps. The studio is equipped with many ingenious devices for the rapid changing of scenes, high-tension electric outlets, fan plugs, cable leads, amplifier panels and other appurtenances necessary to the art of telecasting successful programs from the 540,000 cubic feet of its interior.

Across Lexington Avenue and a block south rises the Chrysler Tower where on the 72nd, 73rd, and 74th floors of the tower—about 1,000 feet above street level—Columbia has installed a 15-kilowatt, 50-ton television transmitter which has cost in the neighborhood of half a million dollars. As the studio and the tower are but a block apart little difficulty was experienced in laying the coaxial cable which carries the high frequencies of the television signal.

The television division of the National Broadcasting Company was assigned studio 3-H for its exclusive use. This studio has every advantage that the combined sciences of architecture and engineering could devise for the nine floors of Radio City devoted exclusively to broadcasting. Studio 3-H measures only fifty-eight by twenty-two feet and has the same full floating construction of the radio broadcasting studios. The ceiling and walls are made of a special acoustical transite painted with bright aluminum which reflects the lights from the overhead grids. This entirely new system of lighting bids fair to change all preconceived ideas of light diffusion.

Through the years, technique in acting has undergone as many changes as the plays themselves and television which borrows from the stage, the motion pictures, and radio will undoubtedly develop its own technique which will probably be a combination of all three. The majority of its stars will have had radio experience of one form or another and, whatever else the microphone teaches, it is a hard taskmaster when it comes to faultless timing and good diction. It is impossible to argue with the clock in a radio studio. A few seconds of human tolerance is all that is allowed to switch in a whole network of stations from coast to coast. Every show must begin and end on time—for minutes are golden in radio. The necessity for good diction and pleasing personality is fairly obvious because all that a "Great Lover" of the micro-

phone has is his voice, plus a crumpled script from which he reads his part. White chalk marks on the floor indicate, not how many feet, but how many inches he may move to the right or to the left. Some actors accustomed to the wide sweep of the stage experience great difficulty in playing an impassioned scene without being able to move around. No amount of silent signals from a director could ever keep John Barrymore close enough to the microphone. In desperation his radio director had a waist high barrier erected. Mr. Barrymore was told that if he clutched that his voice would always carry over the air waves.

Through the years a set of traditions has developed for the production and filming of movie scripts that is certainly more hidebound than the traditions of the Chinese Theater. Probably the best known is the "close-up" which had its use in the old silent movie days when much of the action was carried in the subtitles and the emotions were shown in an image magnified more than a thousand times. It was bad enough to delay the action of the plot when the movies were silent, but when talking pictures came in the convention was so well established that it was carried over unnecessarily, and the audience applauded just the same. Even the stage has some conventions which we still take in our stride such as the gossipy Footman and Housemaid, the eternal telephone with the Butler, or the Juvenile and the Ingénu speculating about the characters whom we have yet to meet.

Generally speaking, acting technique in television is just as simple and direct as on the legitimate stage, with the possible exception that the tempo of most scenes is played more slowly. The actors have more space to work in than in front of a microphone, but still less than that of a movie set. In gesturing, actors must remember the small limitations of a television screen, lest in a forgetful moment they walk completely out of the frame. Whenever possible guide lines which give the boundaries of the set are established outside of the range of the camera focus. Every action, every gesture, almost every inflection of voice has to be timed with great accuracy because so much depends on the outcome. In the movies players are usually able to memorize their lines one evening for the next day's "shooting"; in radio every actor reads his lines from script; in television an actor must be letter-perfect without cueing and he must remember many more cues than in any other type of production.

In television the all-seeing eye of the iconoscope and the all-hearing ear of the microphone detect and magnify flaws a thousandfold. In a stage play subterfuges may pass unnoticed or be covered up with clever acting. No such opportunity presents itself during a telecast. In moving pictures some of the major scenes may require as many as thirty retakes in order to get the best sequences for patching into the completed reel. This saving grace and golden boon of a re-take is denied to television. A single fifteen-minute

drama may require rehearsals every day for a month. Every actor, every camera technician, light operator, sound-effects man, and scene-shifter must know each and every cue, every entrance and exit; every crossing; he must know how and when to use the various props; and when to switch from one camera to another, because no questions can be asked or directions given once the show is on the air.

Three television cameras are in constant use on every set. These cameras are focused at different distances. One takes in the head and torso and corresponds to the "Medium Foreground Shot" of the movies. The second is used for the distant and over-all picture. The third camera mounted on ball-bearing rubber tired wheels is used for moving or panning shots. It follows the action wherever necessary and upon occasion is used for a close-up, although (Allah be praised!) television is eliminating close-up as much as possible.

The same requisites are necessary for making a success before a television camera as in a stage production, namely, a beautifully modulated speaking voice, perfect diction, charm, grace of manner, personality, plus the innate ability to lose oneself in the character. It means that instead of an actor projecting his personality over a single row of footlights he will have to do it over thousands of individual rows in thousands of individual homes. It sounds staggering—but it is not nearly as formidable as it sounds. Actors

who have appeared in the experimental dramas during the past three years have said that being able to move about and to gesture normally removes all feeling of restraint and consequently eliminates "mike fright." They say further that the most difficult thing to become accustomed to is the glare of the lights which, instead of being foot-lights, shine from above. Artists who have had only radio experience and are lost without a script in front of them, and screen actors who have not had the benefit of stage experience will both find television exceedingly difficult.

The procedure of producing a television show is similar to any other theatrical production. After the play is selected, the adaptation made and the parts cast, the director, producer, chief camera technician, sound engineer, and the lighting specialists go into a series of conferences to work out the production details. The script may have to be rewritten several times to accent certain dramatic effects suggested by the engineering specialist. Whole sequences may have to be eliminated and others substituted because it is discovered that the original ones would not telecast well. The exact timing of each speech as well as each movement has to be worked out, in order that the camera engineer may know which of his three cameras to use. Of equal importance to the camera assignment is the amount of lighting necessary for each scene. The lighting engineer is one of the most important members of the technical staff because unless he knows

how to paint his electric blacks and grays with a lavish hand, the resultant telecast will be devoid of drama.

The first reading of the play is similar to that of the theater. The cast is called, the parts assigned and a formal reading takes place. Following this there is an interim of several days for study and then rehearsals are called much the same as for any other production. The stage sets are built first in miniature, and if these miniatures meet both the director's and the engineer's requirements the order is given for scenery and the production gets under way in earnest.

When the cast is letter-perfect rehearsals are held without lighting effects in order to allow the cast to feel at home. Then follow additional rehearsals with lights and cameras and the play is ready to take the air.

The television studio streamlined microphone is mounted on a long boom which can be raised and lowered and swung back and forth. This microphone must at all times be kept out of the camera's vision and yet be as close as possible to the person who is speaking. During the shooting of each individual scene the microphone engineer must know every instant where the following action is to take place so that he can move his microphone accordingly. The same applies to the sound-effects engineer whose job is considerably more difficult than in radio broadcasting as he must always keep his apparatus out of sight of the television camera.

Just before the play goes on the air the camera

technician makes a final check-up of his list of cues which for ready reference he has clipped on his camera adjacent to the focusing aperture. All eyes are fixed on the studio clock. As the long red second hand mounts slowly towards sixty, the director, standing in the control room where all may see him, raises his arm. His eyes shift continually back and forth between the red second hand and the script which he holds. Twenty seconds to go—ten—five—two—down comes his arm and he points to Camera No. 1 to start the action.

Camera No. 1 is not focused on the stage set but instead it is shooting a title sequence and the cast of characters. In other words it is providing the theater program for the production. In telecasting this sequence virtually the same technique is employed as in motion pictures, with the exception that much of the "trick" photography cannot be used in television. Titles in the movies are frequently created by a "lap dissolve" during which the first title is faded out and the next is faded in. This is accomplished partly through camera technique and partly through being able to cut and edit the film. As previously explained, in television there are no cuts and no re-takes which is why a different technique for something as simple as titles had to be worked out.

One method is to focus the television camera on a book, which in hand-lettered script shows the title of the production. Each subsequent right-hand page contains additional information, such as cast of char-

acters, where the scenes are laid, who wrote the television script, who designed the scenery, costumes, and the lighting effects. Each page is turned automatically every five to eight seconds depending upon the amount of reading matter. The last page usually ends with the phrase which leads into the play itself, and as we read this on the screen we hear these same words spoken by an announcer. Other methods are used to introduce television plays, such as trailers moving before a camera, miniature sets, etc.

"As the curtain rises, we see the library of the most famous criminologist of the last century. . . ."

". . . the last century" is the cue for Camera No. 2 which cuts in the scene itself and the play is on.

So much for what is taking place in the studio. Let us look at what is happening elsewhere, from the moment the director's finger pointed to Camera No. 1. to "Hit It!"

In the master control room separated from the studio by two double thick plate glass windows sit the video (sight) and audio (control) engineers, as well as the technician who monitors both sight and sound and watches particularly which camera is shooting. As in ordinary radio, the voices of the actors are picked up by an ultra-sensitive streamlined microphone and broadcast on separate wave lengths. The problem still remains of synchronizing these sound waves with the light waves even though both are translated into electrical impulses and broadcast from the

same antenna. There is nothing worse than watching a charming diva sing a passionate love lyric and, as we watch her lips, have the words hit our ears just a fraction of a second late. Moving pictures, again, have the advantage over television. In the big musical extravaganzas, the prima donna goes through the motions of singing a song without uttering a note. Later she records the song several times on the film track. The best rendition is chosen and her voice is "dubbed in" with the utmost accuracy on the master negative from which all subsequent film prints are made. Because television is an indelible record of reality the singer has to sing at the same time as acting out the part and it is up to the video and audio engineers to maintain the voice in absolute synchronization with the action. These engineers have their own silent means of communication with each other and with the director, who tries to keep an eye on the stage, on the cameras and on the control room all at the same time.

The video engineer has a much harder problem than his sound associate. In a sense he is painting a picture in blacks and grays with a supersensitive electric brush. Knowledge of how to obtain and to project contrasting color values of lights and darks is absolutely essential. Although a man might be the highest skilled electrician in the world and know the answers to many of the most important technical questions, without the ability to visualize how the telecast will look when it hits the kinescope screen, and how to

enhance its dramatic values through the proper use of light and shade, his worth as a video engineer is small.

This brings up an important point for youths wishing to enter television from the engineering end. Up to the present an artist at a convention of electrical engineers was a man sinking fast in a sea of watts. Vice versa most artists considered engineers to be a race apart—and all slightly mad! With the arrival of television, the artist enters a new field. One who can project a neat mathematical perspective on an eight by ten inch screen and yet through tricks of lighting and arrangement of planes make it appear much larger—or smaller as the script demands—has a real job cut out for him. Whether electrical schools will give graduate courses for artists, or whether electricians will take post-graduate work in an art school is difficult to predict, but this much is certain—those men who have had the dual training are far better able to cope with the problems of television.

But to return to our telecast. When the action becomes more animated as the production nears its climax the director changes cameras frequently because special emphasis is required. One camera is often used to shoot a completely different scene from the one in which the main action is taking place. Here is another of television's problems that had to be solved. Audiences are so used to radio plays in which the action is continuous that television executives believe that radio technique must be followed to main-

tain interest. As many different scenes are dressed as will be used in the play. The convention of the musical bridge, used in radio to denote either a change of scene or a lapse of time is seldom used. Television resorts to the voice of an off-stage announcer to denote these changes. If the context of the action makes it perfectly obvious where the next scene will take place, one camera "kills" and instantaneously another camera cuts in on the new scene. This rapid change sometimes leaves the actors breathless as they dash across the studio to make their entrances on the new set, but such are the exigencies of the new art.

The director of a television play leads a harassed life. He has problems to contend with which never confront his brother directors of stage or radio. In the final analysis it is the director who takes all the responsibility for a good or a bad production. Irrespective of lights, scenery, props or costumes, above and beyond all thoughts of kilocycles, megacycles, frequencies or clear channel bands, the director has to remember it is up to him to produce a hit. All of his cast must be approximately the same size and must be reasonably thin, because on the small screen an actor who weighs over 150 pounds or is more than six feet tall appears a giant and thus dominates the whole picture. This question of size is one of the fundamental reasons at present why Grand Opera cannot be televised successfully. Lily Pons is probably the only diva

whose unusual talent and physique would make her a great television star.

Pons has another attribute in her favor. She is a natural brunette. Television directors may secretly prefer blondes but they engage brunettes for a perfectly sound technical reason. Blondes—platinum or ashen blondes especially—do not telecast well. Some cannot be seen at all. The bright overhead lights cause refraction around the head forming a pale gray halo which not only encircles the blonde actress but anyone else playing opposite. In television blondes are known as "blizzard heads." The blondes are advised against dying their golden locks brown, because dyed brown hair photographs lifeless and muddy.

During the early days of the industry the camera's sensitivity was rather poor and only the most violent contrasts of black and white appeared. During this era the make-up used was the clown's white grease paint with black lipstick and the eyes heavily shaded. The actors thus made up found it difficult to "feel" their parts or to work together naturally. This was a serious problem for the engineers and adjustment after adjustment was made in the iconoscope until now this "seeing-eye" has a greater power of definition. The make-up used today is similar to that of the movies—the eyes are outlined in brown, panchromatic grease paint and powder ranging from burnt orange to peach tan are used on the face, and the mouth is painted with red-brown lipstick. Just as in the case of the movies,

make-up is used only for studio telecasts. News events telecast in broad sunlight need none.

It is difficult to predict what the television drama of the future will be. Some of the experts say that it will take the form of a combined "live" show with cinema interpolations to carry the theme; others state it will probably originate some definite art form of its own which will be especially pleasing; still others—these are the pessimists—that television drama will endure only until the novelty wears off. While the predictions of the optimists may be based more on hope than on pure reason, nevertheless it is true no one could have predicted that the flickering Westerns of the nickelodeon days would develop into the remarkable drama of the contemporary screen. Even ten years ago one could not possibly have prophesied that radio would today be a welcome guest daily in 33,000,000 American homes. Will television surpass them both in popular appeal?

IV. LIGHTING, MUSIC, MISCELLANEOUS ACCESSORIES

One of television's stumbling blocks in studio production has been the inability until recently to obtain sufficient light so that the scanning beam could pick out the minute details of the picture. Kleig lights proved unsuccessful because in television after the action once starts it has to be played out to the end—fifteen—twenty—sometimes thirty minutes without intermission or break. The actinic rays of the Kleigs proved harmful to the actors' and the directors' eyes. In Hollywood when a scene is not actually being shot the Kleigs are turned off, and as many moving picture scenes require but a few minutes for shooting, the Kleigs are never turned on long enough to do any serious harm.

Seeking the best possible lighting arrangement, many lighting specialists were called into consultation and as a result of many tests it was definitely established that the Birdseye lamp with its bright metallic base provided the clearest illumination. This lamp was invented by Roger Birdseye, who is perhaps better

known for his work in the fast freezing of foods. The next question arose over the mounting of these lights in banks so that they could be either swung clear, used as overhead drops or as side fixtures. Mr. William Eddy, who is the combination of the artist-engineer previously referred to, solved the lighting problem in a thoroughly practical manner. He made a grid iron of inch and a half zinc pipe which was nine and a half feet long. Each grid iron contained four rows of lights which were staggered in alternate rows thereby eliminating cross shadows and providing steady illumination without glare. In the Birdseye lamp the harmful actinic rays of the Hollywood Kleig have been completely eliminated and although the lights are excessively bright they are not harmful. This grid arrangement is used for overhead, side and spot lighting. A series of table switches and rheostats controls the operation of these lights. As the action on the stage progresses, engineers watching the scanning diagram in the control room can call for more light on certain areas and can be sure of getting it instantly.

The only serious drawback to this great flood of "bottled sunshine" is the heat that comes with it. All the studios in Radio City are air-conditioned but immediately after the installation of the new lighting system in 3-H, additional ducts had to be installed in order to circulate almost three times more air in that studio than in those used by radio.

Mr. Eddy's other serious claim to fame rests on his

creation of "Imby," a super-marionette who was originally intended to be the hero of the first talking cartoon. Imby's actions are controlled by a series of delicate wires which lead to a keyboard. Each key manipulates one wire which is so thin that it cannot be televised. Imby has been used for long tedious scanning experiments and has been marched back and forth before the cameras over and over again in order that the engineers might set their scanning speeds to obtain the best definition of his handsome countenance.

Another aid to the engineers has been Miss Patience, the de-luxe mannequin which has been used for displaying many different frocks in order that fashion experts from the great houses might see which colors and which gown designs telecast best. Without Patience and Imby, television experts would know far less what can and cannot be telecast successfully. No live actors could have stood the hour after hour of grueling punishment that these two went through. Make-up experts from Hollywood used Miss Patience's charming physiognomy as a proving ground for various types of make-up. Masks were tried and many felt that the smooth flat tones offered unusual plane surfaces for lights and shadows. The effects were unusual and startling, to say the least, but as they could not be used for close-ups they were definitely eliminated. When the Birdseye lamp succeeded the Kleigs

there was no longer a necessity for accentuating make-up.

Another important accessory to good telecasting is a musical accompaniment to enhance the mood of the dramatic action. This idea of interpretative music is a carry-over from the movies and from radio, where the conventional lapse-of-time musical bridge is a musical necessity. Because television is more nearly akin to the stage than to the movies, every effort of the director is bent toward making the action seem as natural as possible and music, therefore, is only introduced to obtain greater emphasis or point up a particular scene. Off-stage music is always a problem for the director. He may pick up the music by a separate microphone in which case it has to be blended into the scene by the mixing engineer in the control room. On the other hand he can take a chance and have the music picked up by the same microphone as the one carrying the voices of the actors, which may result in faintness of sound and a slight off-timing. Unfortunately no way has yet been found of dubbing in the music the same as music is dubbed on a movie sound track. Unusual sound effects such as a dog barking, an airplane motor whirring, a loud roll and a clap of thunder have been recorded on records. These sounds can be interpolated into the action merely by playing the record on an off-stage turntable. Most television scripts do not carry nearly as many cues or sound effects as do radio scripts, for the simple reason that

many of the effects that have to be portrayed can be done better by sight than by sound.

For example in a radio drama when the hero says, "Dearest, I think I hear our train coming," the sound-effects engineer gets into action. With his right hand he rolls dried peas inside a toy balloon thus producing the sound of a steam engine coming up a steep grade. With his left he twirls a large wheel with a steel caster mounted on the lower side. The caster travels in a circle over another metal plate which has raised lines at regular intervals so that the noise from the caster makes the regulation "Clickety-clack," "Clickety-clack," in perfect imitation of the steel wheels of a railroad truck passing over rail ends at regular intervals. As the train comes nearer the sound is increased by bringing the balloon and caster nearer to the super-sensitive microphone. As the train clatters into the station yards the engineer blows his regulation two long and two short whistles. We hear the clang, clang, of the engine bell and the hiss of the air brakes (a ten-penny nail drawn over plate glass) as the Overland limited comes to an easy stop. In television we see the actual train in a series of dubbed-in news reel films, complete with sound effects.

Dubbing-in such a sequence is where split-second timing is essential to make the illusion complete, for the news reel must fade out as another camera on the actual set fades in. It is common practice for one camera to continue shooting for several seconds after

another camera has taken up the thread of the story. This is done to make doubly certain that nothing has gone amiss. A third camera always stands by to be rushed forward if for any mechanical reason the second camera was not able to pick up the scene. Video and audio engineers in the control room maintain constant communication with each camera technician by means of an independent telephone line running to each camera, and they are all connected with each other, individually and collectively, so that a request to one is heard by all. This closed circuit is independent of the director's line but he can plug in and out at will. All wear the familiar head-phones of the PBX telephone operator.

Just as radio is responsible for originating a highly complicated system of sound effects in order to stimulate the listener's imagination so television is gradually building up a variety of sight effects. Surprisingly good results have come from photographing miniature sets and scenes. Scale models which have been used with splendid success to set the mood of a scene are white colonial dwellings, a country road winding between hedgerows of roses, and a cobwebbed attic of a house of mystery. A Preparedness program consisted of a model set of lower Manhattan and New York harbor with shipping moving to and fro. A military expert conducted the telecast, proved how a hostile fleet might succeed in doing great damage to American shipping and the topless towers of

financial America unless certain necessary precautions were taken. So graphic and realistic did it seem that one forgot completely that the battle was only a sham taking place in a tub with water only two inches deep, and that the skyscrapers that were being bombarded were only nine inches high.

V. TELEVISION VERSUS THE THEATER, THE CINEMA AND RADIO

Television is too much of a fledgling to predict its destiny in the field of entertainment but it is possible to speculate. Ever since it made its formal bow on April 30, 1939, at the opening ceremonies of the New York World's Fair, heads have been nodding and tongues have been wagging whenever two impresarios of the mass entertainment world met. Will television supplant the theater? Will television supplant motion pictures? Will television supplant radio? In its present form it is exceedingly doubtful whether television will supplant any of these forms of entertainment for definite physical, economic, and psychological reasons. At the present time there is certainly no menace to the legitimate theater either from a writing or an acting standpoint; legitimate drama will have a far greater effect on television than television will have on the stage, at least for many years to come.

Max Gordon, who in conjunction with Sam Harris has produced nearly two score smash hits on Broad-

way during the past quarter-century, says: "Although television offers a remarkable challenge to the producer, the playwright, and the director to create new dramatic forms of entertainment, it would require another Dusé, Bernhardt or Modjeska to tear a great LOVE to tatters in a *single* performance on a seven-by-ten-inch screen. Undoubtedly as the years pass it is quite possible that greater stars will arise than any whose memory is enshrined in our innermost hearts at the present time. A new technique must be developed before television stars will be crowned with laurel."

The stage has not much to fear from competition either in the length of run or for that matter in popular appeal. Even though we live in the machine age, or perhaps on account of it, there is a thrill in seeing a good play or tuneful musical comedy acted out by flesh-and-blood actors never matched by any other form of entertainment, and in all probability never will be matched.

A television show must make such a terrific hit in one performance that requests for its repetition may be so many, so varied, and so obviously genuine that it may be repeated. But even then it is only two performances, outstanding though they may be, but still only two as compared with the 350 or 400 performances of any two-year theatrical hit. There is certainly no danger of competition in the length of the run.

Today television stands much in the same place as

the moving picture industry did a quarter-century ago. It is distinctly a poor relation. To bring it up to its present state of development several of the largest corporations of the United States have spent nearly $25,000,000. To date none of these corporations has received one cent of revenue from the television inventions, and none of these corporations expects to make a dime out of television programs for several years to come. The majority of these companies who sponsored the original research are in the business of manufacturing receiving sets. To sell their sets they must provide programs of outstanding excellence for the potential purchasers of the sets to tune in on. The set manufacturer must bear the cost of the program until sufficient sets are sold to make it worth while for advertisers to become sponsors. Television, unless it discovers a source of revenue at present undreamed of, will be in no position to compete with stage or screen in lavishness of production or choice of talent. The great names will continue to remain where they are unless in the interests of furthering a new art they accept a mere fraction of their established salary. Until several years have elapsed television will be in no position to afford more than young and unknown talent.

Insatiable curiosity on the part of the great potential audience about what happens during the broadcasts of television programs is providing a serious problem to telecasters. So many requests are received

by the National Broadcasting Company that in order to satisfy them a special television circuit was established between the Empire State Tower and the NBC studios in Radio City. In small groups, each under the direction of a trained guide, more than 2,500 visitors daily take the television tour. These visitors actually experience the thrill of being personally televised and projected on regulation kinescope screens on several television receivers in an adjacent room where they are seen by their friends. Each visitor in turn stands beneath the lights before the television camera. The signal is carried by coaxial cable to the Empire State Building, put on the air from its antenna from the top of the tower and is then picked up by the television receivers at Radio City.

It is next to impossible to produce a television show before a live audience. The contrary is true in radio and in fact there are several temperamental radio artists who refuse to broadcast unless the studio is jammed. They claim that they need to have the instantaneous reaction of a live audience for stimulation. Of course there are a handful who prefer to be "Alone with the microphone and God."

To broadcasting companies studio audiences are a mixed blessing. Although every effort is made to control their reactions so that applause and laughter may be timed appropriately, audiences have gotten out of hand on more than one occasion and have almost ruined the broadcast. This frequently happens when

an innocent bit of by-play between two performers tickles the risibilities of the studio audience which bursts into uproars of laughter over what they are seeing instead of the joke that is being broadcast over the air. When this happens the companies are flooded with thousands of letters from irate listeners.

Directors of television broadcasts refuse to allow audience participation partly for the reason stated above and partly because everyone participating in the telecast is keyed to concert pitch; a burst of applause, a cough, a high rippling laugh, a resounding sneeze—any one of these is enough to set the television crew chattering.

During the experimental period of the last three years, telecasts at irregular intervals were sent out by the National Broadcasting Company and were picked up by 200 receivers strategically located throughout New York's fifty-mile metropolitan district. The plays that received the widest acclaim were detective stories —several brief sketches were portrayed from the Sherlock Holmes cycle by Sir Arthur Conan Doyle— or light comedies such as *Susan and God.*

The Mutual-Don Lee Broadcasting System in Los Angeles has had a similar experience. For over a year, from their studio in the Don Lee Building they have been telecasting twice a week a dramatic comedy serial entitled *Vine Street.* The episodes are of fifteen minutes duration each. Mail received from several hundred persons throughout Los Angeles County indicates

that this modern *Perils of Pauline* has built up quite a following.

In a recent episode the characters were in an airplane flying across the Pacific. The fuel failed, the plane went into a tail-spin and crashed on an island. In the first scene the audience saw the flesh-and-blood actors and a real airplane. The tail-spin was shot with a miniature airplane which was handled by invisible wires. The time consumed in showing the miniature scene gave the actors sufficient time to make alterations in their costumes and to reach the set where the crash scene was televised.

Will television supplant motion pictures? Will Hollywood become one of those dim ghost cities?—hollow shells of their former glory—that dot California's hinterland? Will the great physical investments of studios, equipment and leaseholds have to be scrapped as television gets under way? According to the astute showmen of the West Coast there are many good reasons why television cannot and will not supplant the motion picture industry, chief among which is the question of original cost.

Every "A" picture that has been produced in Hollywood during the last five years has cost at least $100,000. Special features and super-specials have topped the $2,000,000 mark. Due to block booking arrangements with theater chains, as well as with independent exhibitors under contract to take a certain percentage, these pictures have been partially if not

wholly financed by the exhibiting theaters. In other words the great majority of Hollywood pictures are made to order. While an absolute guarantee of their gross return cannot be made—the public still has the prerogative of staying away from a bad picture or an unpopular star—nevertheless, the percentage of loss has been reduced to a minimum. Within certain limits exhibitors can predict with a fair degree of accuracy over a twelve-month period what the gross revenue will be from "X" number of pictures.

Moving pictures—the good and the bad—the "A's" and the "B's"—are shown throughout the country in first, second and third run houses. Depending on its popularity the life of an ordinary picture extends from two to six months during which time it will "gross a million" or if not a million, at least a tidy profit for both producer and exhibitor.

When television was first demonstrated experimentally, moving picture companies were lavish in their permissions to allow old feature pictures to be televised. Many of the old favorites were brought from steel vaults and projected across the ether. No charge was made for the use of the print and great good-will resulted. After the telecasts went on the air at regularly stated intervals, even though the broadcasting companies received not a cent of revenue, permission was withdrawn for the use of the film. The film companies were perfectly willing to allow these old films to be used, but the actors demanded additional com-

pensation for telecasting rights although telecasting had not even been dreamed of when these films were originally made. All dramatic features were called in and travelogues and animated cartoons were substituted.

The only definite competition that telecasting can give immediately to the moving picture industry is in telecasting news events. This is contemporary history in the making and it is flashed on the screen the moment it transpires. Roving mobile television transmitters have telecast many interesting and unusual happenings in Metropolitan New York. The telecast of President Franklin D. Roosevelt opening the New York World's Fair was made from a mobile transmitter which relayed it to the Empire State Tower for re-telecasting. Other unusual events that mobile units have picked up have been the arrival of European Royalty, a spontaneous combustion fire on Ward's Island, military parades, horse races, an unexpected suicide (when accidentally it picked up a girl jumping from a tall building), prize fights and impromptu side-walk interviews.

Television cannot possibly compete with the movies in the cost of production, so, until television has wide distribution and is commercially successful, the show that is seen in one's own living room must be enjoyed by different standards. Then, too, there is a psychological quirk of American national character that must be considered. Going to the movies connotes a

All youngsters are thrilled by television programs as this photograph. taken in the home of Mr. J. E. "Dinty" Doyle, shows.

Telecasting enlarged fingerprints as a rapid means of identification.

Control room of NBC's 3-H television studio.

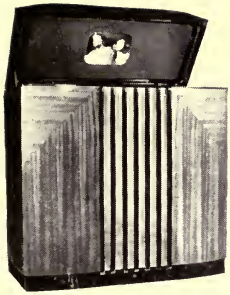
Televising a scene from "Mamba's Daughters," with Miss Ethel Waters.

President Roosevelt opens the New York World's Fair and inaugurates television on the Atlantic seaboard.

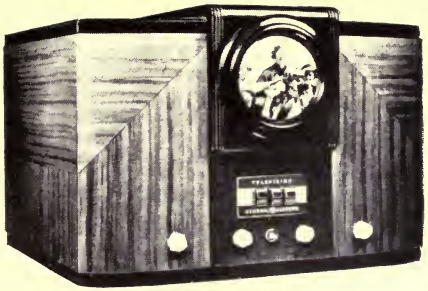
How the President appeared in the kinescope receiver.

The Speaker of the House, Hon. William B. Bankhead, broadcasts.

A television "close-up" of the Speaker.

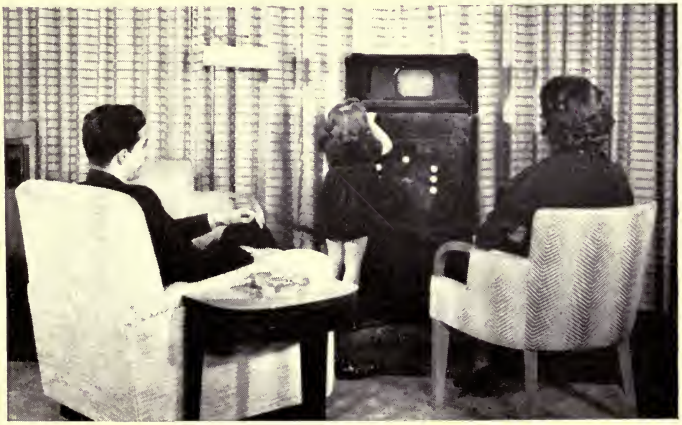


A streamlined console type television receiver.



Small table model receiver for direct viewing.

Larger size receiver used on studio tours.

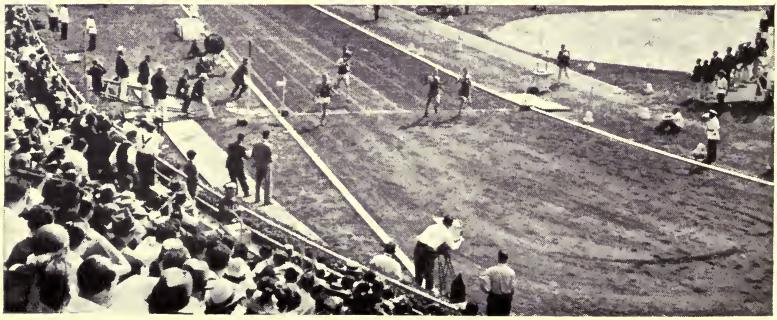


Small compact console type receiver for use in the home.

First baseball game televised . . . Princeton vs. Columbia at Baker Field, New York City.

A new fight champion is crowned.

Note the iconoscope camera above bank at six-day bike race.



The television camera transmitted new records being broken at the A.A.A.A. Meet.

Thomas S. Lee, owner of Don Lee Television Station in Los Angeles, and Harry R. Lubke, director, watch variety program.

Mr. David Sarnoff, President of RCA, inaugurates regular television schedules on the Atlantic coast.

Television mobile trucks in action during television broadcast of the Associated Press activities throughout the world.

party. If the whole family is going there is a certain amount of bustle and stir engendering an atmosphere of anticipated pleasure. If Boy takes Girl it is likewise a date or a party. Within the darkened theater one instinctively becomes inoculated with the identical reactions of the mass audience. Laughter, tears, regret, cynicism, the whole gamut of human emotions are played upon as a harp of many strings. Seated amid the familiar surroundings of one's own living room one would never feel the same intense interest. Why? Mainly because at home there are sure to be minor interruptions. The telephone rings—the driver comes with the laundry—someone starts hunting for an ash tray—or a gossiping neighbor calls. All these interruptions can be taken in one's stride when listening to radio. We have conditioned ourselves to a break in the continuity of thought and can return to our radio drama picking up the threads quite successfully a few minutes later on. We can nearly always keep one ear tuned to the family conversation and the other to the loud-speaker. In television this is impossible because it is shown in a semi-darkened room and requires as complete attention as the moving picture.

Some telecasters have advanced the thought that it may be possible to combine television drama with special moving picture sequences. This method was utilized by the Associated Press when a demonstration of the many activities of the A.P. at home and abroad was telecast for members and delegates attending its

annual meeting at the Waldorf-Astoria Hotel in New York City. After meeting various important executives on the kinescope screen, the Associated Press expert on foreign affairs, De Witt McKenzie, was introduced. He told the graphic story of the A.P.'s coverage of the European crisis in London, Paris, Rome, and Munich. While he talked televised news reels of the event were shown. A Mobile Unit was stationed outside the Associated Press Building and a coaxial cable was run up the side of the building into the news room where it was attached to the television camera. Three hundred editors and publishers in the Grand Ball Room watched receiving sets and saw what went on in the news room several blocks away. A bell rang, indicating an unusual flash bulletin from Europe. They followed the story as it came over the A.P. wires, over various desks to teletype machines that then dispatched it to member newspapers throughout the country.

Instead of being a competitor of the motion picture industry television is certain to be its greatest customer once the union demands for salaries for actors and musicians have been adjusted. Sensing this, several moving picture companies, notably Paramount, have made heavy investments in television. The combined output of the Hollywood motion picture industry is between 500 and 600 pictures a year. The average running time is from an hour and a half to two hours per picture. The great radio networks are on the air

between seventeen and eighteen hours a day each. A radio audience is not interested in a twice-told tale. It is presumed that the television audience will have similar reactions. When telecasting becomes a commercially sound investment, at a conservative estimate it would exhaust Hollywood's complete output in less than six months. It may be that television will become Hollywood's Santa Claus, and enable it to use to the fullest all its equipment and personnel.

The radio has been called more than once the common denominator of the great social order. It has also been called other things as well, but the fact remains that it is the daily welcome guest in millions and millions of American homes. The reason why it is a welcome guest is because one or more programs during the eighteen hours has special appeal or interest for us individually. It may be the stock quotations, the baseball scores, a heavyweight championship prize fight, our favorite news commentator, a dance band, or an interview with an European Premier on international politics. The list seems endless, but the point is that we know in advance that at a certain time we can tune in our favorite station and pick up a program which we believe is worth listening to. Will we be able to do the same with television? Of course—in time. We must not lose sight of the point that nearly five years elapsed after the first national network was established before the first overseas broadcast was accomplished. Another ten years went by before over-

seas broadcasting was considered a common occurrence. How long will it be before we can telecast overseas? We might answer that by asking another, how long will it be before we can telecast over national networks?

For many years to come both television and radio will be necessary for mass entertainment as each has its special field. For example, music is the backbone of all successful radio programs and it is extremely doubtful if this will hold true for television. Experience has proved conclusively that watching an orchestra—any orchestra—for more than three or four minutes is boring to the average member of the television audience. A swing band will hold the attention somewhat longer, but even cavorting drummers, weaving saxophone players and "sending" clarinetists fail to hold the attention for long periods. The reason for this has not yet been discovered. Possibly the size of the screen has something to do with it. The nation-wide sound broadcasts of such notable musical programs as the Philharmonic orchestra, the Metropolitan Opera matinees and the NBC Symphony under Toscanini have raised the taste of uncounted millions until American in a brief span of ten years takes its place among the foremost music loving peoples of the world. There is no valid reason why such programs should not continue to be broadcast by radio.

Vocal soloists will be apt to share a similar fate as the televised orchestra. Watching even the most be-

witching diva carol the "Bell Song" from Lakmé would be of interest only to a class of internes specializing in the action of the larynx. Glee clubs and other singing societies will continue to be welcome additions to sound radio programs, but must be prepared for a not too enthusiastic reception in a television studio. By introducing hitherto unsuspected comedy angles, television becomes dynamite in the show business and can either make or unmake a reputation in a single performance. At present television cannot compete with radio on talent cost. The Kate Smith hour on CBS including time charges is said to cost approximately $25,000 each broadcast. Major Bowes Amateur Hour on the same network is slightly in excess of that figure. Jack Benny's time and talent bill on NBC is said to be approximately $28,000 per broadcast. Charlie McCarthy's Hour costs sometimes more and sometimes less or as he puts it, "It all depends on Bergen!"

Although figures are not available from CBS, NBC or Mutual-Don Lee on talent costs for television, conservative estimates place charges for talent at not more than one-tenth of these top figures. Every cent expended on television costs is capital outlay.

What are the favorite programs of television audiences? If one may judge from the recent series of telecasts over W2XBS, vaudeville is coming back into its own. On a recent bill there was a trained dog act, a juggler of Indian clubs (not W. C. Fields of happy

memory), the world's champion fencing master and his medal winning sister, and four "Alley-Oops" in white "union-suits" who did a tumbling act. This last was a weak point in the program. The white tights were traditional and so they wore them, and as a result their outlines were blurred. Dark tights are a must for television gymnasts. It seems incredible in this day and age that vaudeville should have been resurrected from lavender and moth balls, brought out for examination under the blinding glare of television's illumination and should have been given a welcome reception by a sophisticated audience.

Once the old time vaudeville performer has learned to troupe in the limited space of the television screen he appears to have a definite future in a new medium. The expense of a televised vaudeville show is largely the cost of talent. The vaudevillian is accustomed to the simplest scenery and limited props, and practically no sound or sight effects. The shortness of the act is a high point in its favor for holding the sustained attention at the television receiver.

Because television cannot be broadcast as yet over a nation-wide network it may be necessary to have Stock Companies of television players who make overnight jumps from city to city. These Teleguests or Telestars will in all probability be under contract to some advertiser who has national distribution and who contracts for the same time every evening over a number of television stations across the country. In

this manner the traveling troupe will be able to repeat the same performance night after night until they have covered the country. Repetition is bound to improve timing and acting, and from these pioneer stock companies we shall learn more of the mechanics for the successful writing and producing of television shows.

VI. SPORTS AND NEWS BROADCASTS, POLITICAL SPEECHES, MILITARY MANEUVERS

The British call them "Actualities" and we call them "Special Events," but we both mean the same thing, namely, the happenings in the day's grist of feature news. Broadcast over television, these parades, airplane christenings, and statue unveilings are far more interesting than when seen in subsequent news reels, because we sense that we are witnessing the actual event and not a carefully edited motion picture version.

These news-telecasts have a spontaneity about them which cannot be entirely defined. It is like following in the wake of a star reporter and not only seeing and hearing everything he sees and hears, but also listening to him discuss everything in its proper perspective. There is also the added excitement that one might stumble on the biggest "beat" in the country, or at least see and hear something that would have to be cut out before a news reel could be shown in the

neighborhood theater. To follow television's star reporter affords greater pleasure to the ever growing audience than anything else at present on the kinescope screen.

To the sports fan no Magic Carpet of Bagdad was ever half so wonderful as the smallest television screen. In one day he might see a televised baseball game between two championship teams, go to a horse race, attend a track meet, and have a seat in the bow of the steward's launch as five paper-thin racing shells come down the river. The great advantage is that you do not have to move from your office chair to see an inning or two of the World's Series and then get back to work. Of course, if your conscience permits, you can hang the

IN CONFERENCE
DO NOT DISTURB!

sign on your door, plug the telephone and watch the whole double-header. It's a great temptation! If your long distance call does not come in in time and so makes it impossible for you to attend the Army-Navy game, you can sit in your office, wait for your call and, while waiting, watch the game on your receiving set and enjoy nearly all the thrills and excitement of sitting on the 50-yard line.

Television broadcasts of the famous turf classics open up a whole new world of sport for racing enthusiasts. Not only will telecasting provide a great

blessing for stay-at-homes but it will also definitely provide a wonderful drawing card at all pool rooms where bets are made. Instead of the long pause while waiting for the numbers to go up after the race has been run one can know immediately the happy or dismal truth by following the race on the kinescope. Incidentally, whenever a race is televised, no possible opportunity can exist for misunderstandings between bookmaker and bettor.

For the first time in 159 years that it has been run, the Epsom Derby, probably the most famous horse race in the world, was telecast this year. There are only 14,000 television sets in all of England, yet it is said that television increased betting threefold and that upwards of 1,500,000 pounds sterling changed hands as the result. Three cameras were employed to obtain the greatest efficiency. One camera was placed opposite the starter's box, a second was mounted on a platform above the heads of the crowd showing the field rounding Tattenham Corner, and a third camera picked them up at the finish. Plans were even suggested to mount a camera on the top of a truck and televise the race from the inside of the track. To do this would have meant keeping the great crowd off the inner lottings, a privilege enjoyed since early in Victoria's reign. This was voted down as not being a sporting thing to do, and, secondarily, it was feared that some of the thoroughbreds would shy or break stride at the sight of the unusual camera and truck.

American correspondents who cabled accounts of the telecast united in declaring that it was undoubtedly the most successful of a large number of sporting events that had been broadcast from the station at Alexandria Hall in the heart of London. There was no interference in the transmission and through the use of specially ground lenses images reproduced on the screen were unusually clear.

The first baseball game ever telecast was played between Columbia and Princeton at Baker Field, New York, and won by Princeton 3 to 2 in the tenth inning. The group of reporters who watched it on the kinescope screen kept box scores quite easily and, hard-boiled as they are, all cheered when a man stole home! If it had not been for the announcer, Bill Stern, it would not have been possible to distinguish the players of one team from the other. Both teams wore light grey uniforms. Princeton had orange sox and Columbia wore light blue. On the television screen the players appeared dressed in white so, if the championship games are to be televised, some distinguishing dark mark must be worn.

A whole new world is open to public speakers through the use of television, because any speaker worthy of his salt will have a hand-picked audience waiting for him. But speakers fall into the same category as singers and actors and unless they are slim, dark, with well-trained voices—in other words unless a man is a spellbinder who can summon up all the

remarkable histrionic ability, wealth of gesture, and facial expression of a William Jennings Bryan, few persons will continue to listen to him after the first fifteen minutes.

Since television offers the speaker so much greater latitude than in an ordinary flesh-and-blood address wise ones will take advantage of every mechanical aid. The following suggestions are by no means all inclusive but are merely offered to stimulate the speaker's own inventiveness.

Let us suppose that the speech is political in nature, that the speaker is a candidate for office, seeking re-election to the House of Representatives. Following an off-stage introduction, the Hon. John Doe of the 451st Congressional District appears and during the first three minutes he reviews briefly his campaign promises of the last election and tells how he has fulfilled them. This is an over-all statement and in line with what his constituents expect. During the next three minutes he becomes the fighting Jack Doe whom the home-folks sent up to Capitol Hill to do their bidding. There is a lap-dissolve and Jack Doe proceeds to show and talk about various bills in which he is interested. Let us suppose for a moment it is good roads. After showing a chart of the annual federal and state appropriations for roads, Jack comes right down to cases, and tells his audience just how big a slice of the federal appropriation he was able to get for his own congressional district. During the next

minute he shows various flashes of several bills which he sponsored in the House and which were passed. Each one of these bills carried definite appropriation for a definite number of dollars to be either matched with similar appropriations from the state or spent outright. Two minutes more—with brief cutbacks to the speaker to recall his surroundings and face to the audience so that they can carry the secondary mental picture of him as he speaks, he shows in close-ups an enlarged scale map of his district and of the roads he proposes to build not if, but when he is returned to his rightful seat in Congress. To clinch his argument during the next three minutes he has a home-made movie on 16-mm. film run, which shows clearer than any of his own words the exact location of the fine roads that have been built, and also the site of the proposed new roads. Naturally in these movies he is shown in a prominent role, receiving the felicitations of his constituents, his faithful wife on his arm; talking with some of the most important state officials, the governor if possible—and advisable; consultation with the state road engineer—he has left at home the top hat he wore with the governor and he is once again Jack Doe, "Homespun Jack, the People's Friend," dressed in flannel shirt, boots and a snap brim Stetson—off on a tour of road inspection.

After the conclusion of the brief movie we return to John Doe for a minute or two while he makes his transition from what he has done and plans to do to

what his opponents have done and plan to do. These "Straw Men" can be disposed of quite easily as they have no opportunity for appearance or rebuttal. Then a flash to a page of hand-picked clippings which is always a good final clincher in any political argument. As a finale the television camera returns again to the speaker and we see him in a most serious mood as he sums up his arguments. Off-stage music which is heard faintly during the summation becomes louder and we recognize "America the Beautiful." The Hon. Jonathan Doe turns and as the Stars and Stripes flutter in the strong breeze (created by an off-stage electric fan) he recites the same salute to the flag that every grammar school student knows by heart.

There is nothing new about political speeches over the radio. Nor is there anything new about a speaker citing facts and statistics to prove his point. From September to November every year the air waves are filled with little else. But when statistics are telecast and they can be understood with the eye as well as the ear they will carry far greater conviction than ever before. The underlying reason is simple. Comparatively few persons are able to do mental arithmetic with any degree of speed or accuracy, consequently when long sets of figures are read over the air they go in one ear and out the other. When these same figures are presented to the eyes—that is a different story! We are all accustomed to tabulating columns of figures. Totals are something that everybody knows

something about. When these totals tell a graphic story through carefully built-up comparisons, the eye and not the ear transmits the concept to the brain, and the result is impressive.

Possibilities opened up for the political speaker would seem to be limitless. Will television supplant all political rallies, marching clubs and general ballyhoo incidental to an election? Definitely, no!—although it may serve to augment them. Every political potion is brewed with ninety per cent enthusiasm, nine per cent reason and one per cent logic. Any campaign that departs from this time tried formula is doomed to failure at the start. Although denying it at every opportunity, America is swayed by emotion in the conduct of its national affairs and by reason in pursuance of individual business.

Television is expected to play an important role in the next presidential election. It is possible that the two major political conventions will be telecast and nearly a year ago promises were made that the next Inauguration ceremonies would be shown in their entirety. When making the promise, however, the officials made them contingent on the weather. Although successful telecasts have been made on rainy and cloudy days, the definition of images has not been clear. Just as a good radio personality has become increasingly important for men in public life, so in the future a good television presence will be important for candidates to office. Therein lies the danger. We may find the mass

mind voting for a handsome actor whose speeches have been "ghosted" for him. The unsuspected comedy angles may apply even more thoroughly to politicians than to aspiring quartets, so those with peculiar mannerisms had better take a few lessons to overcome them, lest they be laughed out of office.

Every July and August war games carried on by various National Guard units have been broadcast by local radio stations and have proved programs of mild interest. With sight added to sound these games will take on an entirely new meaning because even the best description of a dog-fight between rival planes in the air does not begin to have the same thrills as seeing it for oneself. Similarly a telecast from a plane flying high above America's battle fleet engaged in firing broadside salvos will be infinitely more exciting than a description of the same scene because here again showmanship can transport the audience from one television camera on the deck of a battleship to another in the spotting plane high overhead. One may see a shell fired from a sixteen-inch gun and the next second watch the shell burst, because with television one is traveling at the highest speed known to man—the speed of light, 186,000 miles a second! No better salesman for the necessity of augmenting our national defense exists than television, for here the taxpayer is enabled to see where his hard earned taxes go.

Television's possible role in this war for use in spotting enemy targets from an observation plane, re-

laying the information along secret wave bands to headquarters, which in turn furnishes the necessary data for artillery fire, reads like one of the fantastic comic strips in the daily press. Despite official denials the experimental section of the U. S. Signal Corps has been busily engaged in working out many new communications developments with television as a base. The office of the Chief Signal Officer is in constant touch with the large industrial laboratories throughout the country and a working arrangement exists whereby any new developments, inventions or operation practices are sent directly to the Signal Corps. Several of the industrial laboratories have officially sealed doors where secret work for the government is carried on.

One of the most interesting inventions was patented in the spring of 1939 by Roland John Kent of Chelmsford, England, and assigned to the Radio Corporation of America. It is a system to enable plane pilots to make blind landings in fog. On the landing field are two transmitters, one for television and one for short-wave radio which are synchronized. On the plane are corresponding receivers also synchronized. In heavy weather the field sends to approaching planes all necessary information such as name of the field, wind velocity, and approximate visibility. On his own receiver the pilot has a complete picture of the field and the necessary gliding angle to land safely.

VII. PUBLIC SERVICE PROGRAMS

TWENTY years ago no one could have foreseen how radio could possibly have affected the lives of all of us. Yet in that short time we have seen the buying habits of the nation altered, as with radio has come a much more intense study and exact knowledge of markets; we have seen the provincialism of the nation eradicated as our understanding of sectional problems has increased; we have experienced through radio a great cultural upsurge as the finest speakers, actors, and musicians have brought the full flower of their art to the most remote outpost. It is impossible to predict what role television will play in changing the habits and customs of the individual and, through each one of us, changing not only our own way of life but that of our neighbors across the seas. According to A. H. Morton, NBC Vice-president in Charge of Television, the intimate nature of television may eventually change the entire amusement habits of the nation.

What you see through your eye makes a far greater impression on you than what you hear through your ear. The phenomenal rise and tremendous circulation

of tabloid newspapers and picture magazines shows how strong the emotional impact of vision is.

How great a part television will play depends entirely on the technical and economic progress that is achieved in its development. It has been proved already that it can play a real part in disseminating information on highly technical subjects.

A successful experimental demonstration was held in the spring of 1939 at the Israel Zion Hospital in Brooklyn, N. Y. Seventy-six doctors, internes and nurses of the hospital sat in an auditorium in one building and watched by means of television a staff surgeon perform a delicate operation in the operating pavilion which was situated in another building. All the doctors and nurses agreed that never before had it been possible to watch at such close range the skillful technique of the surgeon's hands, and the New York newspapers the following day hailed it as opening up an entirely new method of teaching difficult surgical technique. During preceding days prior to the actual telecast of the operation, several rehearsals were held so that the professor of surgery and his assistants knew the exact part each was to play. Extra illumination was furnished by four lights encased in water jackets. Excessive heat from the high power globes was carried off by the running water which at the same time offered excellent light diffusion. The television camera was mounted on a scaffold directly above the operating table and focused at close range

upon the patient's abdomen so that all of the surgeon's actions appeared in close-ups. Directly opposite the surgeon's position at the table a sight and sound control cabinet was installed so that at all times as he worked he could be kept in focus. Outside of the camera's range was suspended a sterilized microphone, and the technician and the control engineer were both scrubbed surgically clean—in the best hospital manner—and were required to wear gauze masks and rubber gloves the same as the chief surgeon and his staff of assistants.

Immediately after the patient was wheeled in, the surgeon began his lecture informing his class what he proposed to do and how he proposed to do it. He then proceeded to demonstrate, step by step, an intricate operation which lasted for exactly thirty minutes. Once or twice during the course of his remarks he asked that the camera be moved from side to side to give added emphasis to some particular point and show more clearly how each step was completed before the next step began.

Following the operation the superintendent of the hospital declared that television sets would be installed at once in the offices of the staff doctors so that each may tune in from time to time when an unusually interesting operation is in progress. He pointed out that even in the best equipped clinics students cannot see nearly as much from an amphitheater of what actually transpires during an operation as on the

kinescope, because in the operating theater the professor is of necessity surrounded by his assistants and nurses and the students have to remain in their seats at a distance. Naturally such telecasts would never be included in programs broadcast for the general public but would be transmitted locally on special wave lengths.

There are, however, several other important fields besides the surgical where television programs can do an unusually effective job of teaching. All the sciences lend themselves to this type of visual instruction, chemistry, physics, biology, geology and botany can through television provide fresh sources of information.

Approximately 100 advanced students from New York University attended in a body the broadcasting of a regular classroom lecture on biology. The director of research set up a high power microscope with regulation camera attachments sufficiently large to permit the two television cameras to work directly on broadcasting the smears. Instead of 100 microscopes being necessary to accommodate every member of the class with the accompanying confinement of attention, the students were able to sit back comfortably and take notes in the ordinary manner.

Through television it will be possible to employ the finest teachers in the country who are masters of their subjects. In radio the outstanding example of this type of teaching is furnished by the "Music Appreciation

Hour" directed by Dr. Walter Damrosch, dean of American orchestra conductors, for over forty years conductor of the New York Symphony Orchestra. Today this program is part of the curricula of more than 77,000 schools throughout the United States. It is estimated that approximately five million boys and girls derive inspiration from Dr. Damrosch's remarkable exposition. Think what it would mean to these young people if sight could be added to sound.

Dr. John Studebaker, director of the Office of Education, U. S. Department of the Interior, and his associates have succeeded in unifying many different educational activities in radio, and there is every reason to suppose that the same policy will be continued on even a larger scale with television. Members of the Parent-Teachers Association Council, the National Education Association and the State Boards of Education have expressed keen interest in the educational possibilities of television. The teaching of history, for example, can be made much more stimulating through visual instruction. The vaults of the Library of Congress, the British Museum and the great university libraries here and abroad contain valuable historical documents which are not available for direct handling by the general student. But these official and private papers could be shown on the screen of the television receiver. Even younger students, studying the history of the Revolution, could be shown actual muskets, uniforms and equipment of the American

and British forces. Each program telecast could be considered an integral episode in the serial and made more exciting than any contemporary fiction through being illustrated with the papers, belongings and historical buildings of our ancestors. No better means of disseminating information regarding the privileges and rights of American citizenship, and preparing foreigners for naturalization, exists.

English, economics and sociology all lend themselves to this improved technique and would find as much or even greater acceptance in the adult world. In radio with each succeeding year it becomes increasingly difficult to differentiate between the so-called juvenile programs and those produced for adults. In all probability the same situation will hold true for television, so that many of such programs would have to be telecast during an evening hour.

Programs in which education has played an important part have always been incorporated in those telecast during the past year, six nights a week, from the Don Lee station in Los Angeles. In planning these programs Mr. Thomas S. Lee, president of the Don Lee Broadcasting System has cooperated closely with the graduate school of the University of Southern California. These educational subjects have included the origin of the alphabet, charcoal drawing, practical pottery making and architecture for the home builder. There have been demonstrations of glass blowing, and skiing instructions. Famous sportsmen have shown

Father just how to cast a fly, how to sink a putt, and how to improve his backhand stroke; Junior has been taught some fine points of fingering on the cornet; his Sister has had expert instruction on how to dress her hair; and their Mother has been shown how to decorate a cake and the most expert way of cutting out a dress. According to the mail response, these informative features have been the ones that the public has enjoyed the most.

In one of these programs a test was made which, astonishing today, bids fair to be a commonplace in the world of tomorrow. The right thumb print of Police Inspector J. V. Authier was found on a drinking glass and an enlarged photograph of it was secretly prepared. This thumb print, placed on the usual record card was then slipped in among several hundred thousand bureau record cards of criminal suspects. Except for the three police officers who had prepared the test, no one in any of the police stations in or adjacent to Los Angeles knew of the existence of this bogus card. During a regular evening television broadcast this thumb print was flashed on the screen and identification urgently requested. Within ten minutes the Long Beach Station had found the card and telephoned the correct name of the "criminal" to the broadcasting studio.

Parole officers say that most law violations are committed by persons having previous criminal records. When television is established nationally, finger-

prints could be flashed to the Department of Justice in Washington a few minutes after the discovery of a crime and, in case of an old offender, identification could be made immediately.

Television will definitely have to dedicate a large percentage of programs to the service of the public, first because the public expects it, and second because it is sound business. It is an axiom of radio that the audience keeps tuned to that station that puts on the most worth while programs.

Within a month after the official launching of television, the National Broadcasting Company gave its first civic education program. In cooperation with the New York City Police Department and the Board of Education, the telecast was built around a simulated accident. There was a baseball game among school boys at 51st Street and Queens Boulevard, Queens, and the dangers to children of playing in the street were stressed. The Police Department showed also how it apprehends hit-and-run motorists and tests both drivers and their cars in emphasizing the need of greater caution among drivers. It also showed all the elements that make automobile traffic in New York so fraught with danger to motorists and pedestrians alike.

Municipalities have generally resorted to lesson posters in an effort to keep down traffic accidents in city streets and prizes have been offered for appropriate slogans. All these scattered efforts lend themselves particularly to coordination on a general program to

be broadcast by television under the auspices of the Police Department acting in conjunction with other civic bureaus. Such a series well dramatized not only would be easily understood but also would definitely be productive of results.

Another series which could be televised with benefit in service to the public, would be one dealing with public health and modern sanitation. Sanitation as we know it today is not practiced with the same vigilance outside America. According to recent statistics published by forty-five cities of over 100,000 population the chief offenders against the public health in our country today are the foreign born. To tell the story of the necessity for sanitation as graphically as possible each episode of the series could be devoted to some particular phase of public health such as "Why Personal Cleanliness Acts as a Safeguard against Contagion and Disease," and "The Importance of Good Ventilation."

Many of the experts of the Department of Agriculture have been waiting for a long time for an opportunity to sow the good seed of soil conservation. Every school of agriculture and every land grant college is a recipient of a continuous stream of literature coming from the Department on the problems of soil erosion and their solution. To such experts as these television is a miraculous messenger because across its fluorescent screen can be spread the gospel of conservation. Such television programs could be

individualized for every section of the country and it would no longer be necessary to issue blanket instructions and then note all the places where they did not apply. The Forestry Service could teach us how to behave in the forest in order to avoid the ravages wrought by the careless flick of a hot spark from a cigarette. And the Federal Housing Administration could depict graphically how an increase in home building might bring back prosperity—from around the corner!

VIII. WHO PAYS?

INSTEAD of developing gradually into public favor as the steam train, telephone, moving pictures, airplane or even radio, television has been catapulted on to the front pages with terrific fanfare. The country as a whole certainly knows that there is a great new force at work in the world and everyone is anxious to see how it works, and who pays.

We have examined briefly some of the "Hows and Whys" and it seems quite appropriate that we should now consider who is going to foot the bill. Will the same system of advertising sponsorship be adopted for television as is used to pay the cost of the present radio programs?

Will the Federal Communications Commission step in, declare television a ward of the government and then proceed to charge an annual tax on each television receiving set as is done in Great Britain?

Will there be a coin slot attached to each television set, as one writer has suggested, on the principle of the-quarter-in-the-gas-meter?

To bring television up to its present state has cost

in round figures $25,000,000 during the last twenty years. More than two-thirds of that amount was spent within the last five years. This sum includes $10,000,000 spent by the Radio Corporation of America and its subsidiary companies, including the National Broadcasting Company, the RCA Laboratories, and the RCA Manufacturing Company. Columbia Broadcasting System, General Electric Company, Philo Farnsworth, Westinghouse Electric & Manufacturing Company and the Don Lee Broadcasting System have spent among them approximately $4,000,000. This investment has been made with a long view to the future. The remainder of the $25,000,000 has been spent abroad, largely in Great Britain.

Every other country, with the exception of the United States, controls both radio and television as a government monopoly. No programs are presented unless they first pass the government censor board, no musical compositions of whatever nature are allowed on the air unless sanctioned by the government musical director and his committee of censors, no play is allowed to be produced unless it is written by someone who is *persona gratissima* to the government and not then, unless the finished product extols the government's official viewpoint. The cost of entertainment and news—the latter usually presented by the government department of propaganda with ample coloring—is defrayed by a government subsidy plus a direct tax on each set. When a government pays for a means

of communication, even though it denies drastic censorship, as does England—it is most touchy concerning the slightest remarks made over the air waves, as American journalists acting as guest speakers can testify.

Criticism has been rife during the last few years that Europe was out-distancing the United States in television development, and cited the programs sent out spasmodically from the Eiffel Tower in Paris and the daily programs which the British Broadcasting Corporation has been telecasting from Alexandra House for the last three years. Returning travelers reported that television was being shown in the cocktail lounges of the smart hotels, and in moving picture theaters and that 14,000 sets were in homes within the thirty-mile radius of Metropolitan London.

Television could have made its official debut on regularly scheduled programs in the United States, several years ago because every country abroad has been using the American electronic system. This has been made possible by a cross-licensing agreement with the Radio Corporation of America. Soviet Russia, Poland, Holland, Sweden, Italy and Germany have all been conducting television experiments but as most of the European stations are under strict military control, very little information about them ever seeps across the Atlantic.

It is true that Europe has been having television programs regularly for some time, but until recently

these programs were crude. Instead of using the 441 lines that American companies have accepted as standard, Europe has used 220 lines for the definition of the image. This has meant that the pictures were blurred. Radio and moving picture entertainment abroad is not on as high a level as in this country because the audiences are not so exacting and hence they enjoyed television productions that would have been uninteresting to an American audience.

No American company operating on private capital wished to place sets on the market that would become obsolete in a short time and thereby antagonize the owners. In other words a large part of this $14,000,000 spent in America was devoted to original research in perfecting the clarity and reception of the television signal, so that once a set was purchased it would be good for several years.

A government monopoly of either radio or television is the last thing to be desired in the United States!

Similar to freedom of speech and freedom of the press these two channels of communication must remain open and untrammeled. In such freedom lies embedded the fundamental system of checks and balances upon which depends our whole system of democratic government.

David Sarnoff, President of the Radio Corporation of America, in a paper prepared for the American Institute of Physics declared:

"Some social scientists have pointed out the greater possibilities of propaganda when presented by television. The great mass of the human race is not critical, and temporarily, at least, may be swayed by appeals to the emotions rather than to reason. In European countries which have succumbed to dictatorships extraordinary changes have been brought about in a very short time, with the aid of radio propaganda, in the expressed beliefs and actions of vast populations. These have been led to accept whole ideologies contrary to their former beliefs, because of skillfully presented ideas which have been spread to every home in the land with the speed of light and with the minimum of effort. The advent of television makes it even more important than heretofore to preserve for radio broadcasting in our country the precious right to freedom of discussion, and to guard against its exploitation for transmitting propaganda intended to arouse destructive class struggles, racial animosities or religious hatreds."

Granted then that the American way of using private capital and initiative for broadcasting television is the right way. This definitely eliminates a monthly or annual program tax.

If the advertiser is then to defray the cost of the television program, it will be well to acknowledge at the outset that it will cost the sponsor considerably more than a radio show using the same amount of time. For one thing the actual cost of transmitting

television is almost twice as expensive as radio because two circuits are used—one for sight and one for sound. Second, the talent costs will be greater even though unknown performers are used.

In radio, actors appearing in a dramatic skit are not required to commit their lines to memory. They are allowed to read them from the typed script which means that for a fifteen-minute or half-hour show two or at most three rehearsals are all that are required. Radio actors are not paid for these rehearsals. In television daily rehearsals of ten days to two weeks are necessary in order to put on a single one-hour performance. As previously stated not only must every actor be letter-perfect in his part but he must also remember a long list of complicated cues. Naturally, actors cannot be expected to devote two or more weeks exclusively to the rehearsals of television plays without some remuneration. How much this base pay for rehearsals will be, and what the minimum pay for actors in television shows will come to are two of the questions at present under discussion by the American Federation of Radio Artists, an American Federation of Labor affiliate, which controls ninety per cent of the radio talent on the air at the present time.

In addition to actors' salaries and time costs, there are other production costs which are properly chargeable either directly or indirectly to the sponsor. These include stage sets, any unusual furniture, props and costumes. To all intents and purposes a television

show is exactly the same as a legitimate theater production with the exception that it is much shorter and that, instead of being presented with the sincere and heartfelt hope of a long run, it is only one performance.

The British Broadcasting Corporation recently issued an annual statement, showing that to provide three program hours a week throughout the year cost $2,000,000. Taking into consideration that production costs including artists' salaries, studio personnel and physical equipment are based on a much lower scale abroad than they are in this country, it is estimated that comparable program hours in America would cost $3,500,000. Although maintaining no fixed schedule of programs during 1938, the National Broadcasting Company spent more than $750,000. With its increased regular schedule during 1939, it is believed that more than twice that amount will have to be expended to maintain the same standard of interest.

When there are so many deterrents why should the sponsor divert part of his advertising appropriation away from such proved media as radio, newspapers, magazines, bill-boards, etc., to assay the dubious role in an unknown field thereby risking many thousands of dollars for a gain which is highly problematical? But is his gain so problematical?

Fifteen years ago advertising solons said the same thing about radio. It might be all right for those companies whose earnings were so high that they wished

to establish losses for income tax purposes but for any sane advertising investment in increased profits—No! Representatives of newspapers and magazines for a long time refused to admit that there was such a thing as radio competition. But in the words of Joseph Penner, "There came a day!" A day of reckoning it turned out to be for many advertisers who discovered in radio a speed of action on the part of the buying public hitherto never believed possible. When the first national network was opened by NBC, sales of products advertised on coast-to-coast programs soared. True, time charges were high and immediately went higher. Talent costs mounted—but despite their skyrocketing—profits to the advertiser continued to increase in greater proportion. Certain artists established a feeling of loyalty, of believability, of trustworthiness which, in turn, was carried over to the product which they were sponsoring. This loyalty toward artist and product immediately translated itself into a boomerang of sales that swept across the country and back again the day following the presentation of the program on the air. As the months passed these after-program sale days gradually increased to several days a week which meant a tremendously increased volume of sales and each month showed a perceptible percentage of gains over the month preceding.

Of course it is foolish to say that all advertisers made huge gains. Many did not—can not—and will not. There are many contributory causes. The most

successful advertisers on the air are those whose products are small units of sale and have mass distribution. A large unit of sale, which would appeal to a limited number of listeners—yachts, for example —would be ill-advised to take an air program. It is not always a poor program that fails to attract the radio customer—the failure lies in a product which is beyond his means or needs. On the other hand the product may be suitable, priced sufficiently low to meet competition, enjoy mass distribution, and yet fail on the air because of mediocre program content.

It is likewise foolish to say that all television advertisers will be successful. There are many pitfalls, but on the other hand there is a unique advantage. In no other medium is it possible to show the actual product and demonstrate its use, both visually and orally. The magic of the human voice in radio has done more to make sales by its hortatory injunction, "Don't delay, see your dealer today," than any amount of cold type could ever do. Through the addition of sight of the product to the voice of the announcer, the potentialities are unlimited. Using radio advertising as a yardstick and applying many of the same principles of merchandising which have been developed by the broadcasting networks, the individual stations, and the members of the National Association of Broadcasters the television advertiser may discover that a pot of gold lies at the consumer's end of television's rainbow!

IX. SUGGESTIONS FOR SOLVING THE SPONSOR'S PROBLEMS

No TELEVISION commercial programs have been broadcast thus far over the air. How soon the Federal Communications Commission will issue licenses to the broadcasting companies authorizing them to sell time depends on that other vital factor—the sale of television sets. A radio station, whether operated individually or as part of a network, receives its license from the Federal Communications Commission for a twelve-month period. In this license it is stipulated that the station shall operate "in the public interest, convenience and necessity." Because the network is merely an affiliation of stations for the purposes of revenue the same stipulations apply to the network as to the individual station. The problem arises how to define "public interest, convenience and necessity" when applied to television stations. Everyone is waiting to see what the Commission expects to do and the Commission appears to be waiting for the public before issuing any licenses. In the meantime certain of the large advertisers have been besieging the exist-

ing television stations for contracts, as they feel the distinction of being pioneers in the field will, in the beginning at least, be reflected in sales. As no one knows just how long it will be before enough sets are sold to warrant the Commission to issue licenses, the National Broadcasting Company has offered free time on the television air to those desiring to experiment with different types of programs using live talent. Three department stores, three watchmakers, a grocery chain and a hosiery manufacturer were among those who accepted the invitation.

For the sake of argument let us estimate that there is a minimum audience of five for each receiving set. This may be a low figure for wherever sets have been shown in dealers' windows or on shop floors the crowds have been enormous. Some of this may be charged off to novelty and to the public's insatiable curiosity concerning every new invention. If 10,000 sets of all makes are sold the first year, that would create a potential market of 50,000 or the approximate population of a small city. It is possible that the F.C.C. might consider this a sufficiently large audience to issue a license for the station or stations that could demonstrate such a coverage.

When will sufficient sets be sold? This "X" in the problem is the human equation. You—all of you—who dwell within the radius of a television station are the ones to decide. The moment sufficient desire can be stimulated for Bill, Jack and Tom to start

envying that little whipper-snapper Jimmy his new television set which brought him in the last heavyweight prize fight—or for the whole neighborhood to start discussing a delightful television tea that the smart, young Mrs. T. Jonathan Doe gave, at which the guests viewed on the television screen the smartest creations of the Paris openings worn by exquisite models in a stunning parade of modern fashion, then television will be up and away over its final hurdle toward its destiny of volume consumption. When this happens the price of sets will come down, steady growth will set in and the most dramatic advertising medium ever devised for quick results and fast profits will go into action!

In spite of warnings to the contrary issued by radio set manufacturers who for obvious reasons state the present flurry over television is only ephemeral, the fact remains that many of the country's largest corporations, whether rightly or wrongly, have invested heavily in television's development and both from a sense of business pride as well as for more cogent economic reasons, are out to see that television will take its proper place in the entertainment world. And that proper place need not interfere with radio's well established position any more than the airplane supplanted the automobile as a means of travel.

One of the great advantages that radio had in the beginning was the ability of almost anyone to make his own receiving set. A few coils of copper wire, a

crystal detector, a couple of vacuum tubes and a set of headphones and you were in complete readiness to hear the finest programs. You could buy the entire equipment from a department store for well under five dollars.

Unfortunately an analagous situation does not hold true with television. If one is an amateur of wide experience it is perfectly possible to build a set, but the problems of construction are entirely too technical for the same fanatic youth who in the cat-whisker reception days of radio made his own set in the attic and caused the family no end of sleepless nights by announcing at dawn that he had at last got CALIFORNIA!

It is impossible to manufacture the kinescope at home. Its size regulates the size of the picture and it sells for $25 for a five-inch image up to $95. One company offers a kit of parts at about $79.50 exclusive of the kinescope tube. Other manufacturers will go on the market soon with similar kits of parts and competition may bring down the price slightly. Unless the amateur builder has had technical experience in handling high voltages it is best for him to have the set connected to his radio, and the special antenna installed by a licensed television electrician.

Manufacturers are placing two types of home receiving sets on the market. Those for sight only, which can be connected to the customer's short-wave radio, cost from $125 up. Sets for both sight and sound will in the beginning cost from approximately $200 up.

The various manufacturers are all making both the table set with a small screen which is viewed directly and the console type. In the latter the image is reflected in a mirror set in the lid. As soon as the manufacturers are forced into quantity production by the demand for sets, the price will inevitably come down as it did in the case of electrical refrigerators and automobiles.

In cities, particularly, it is very important that proper care be exercised in the installation of the antenna. Tall buildings are apt to cause reflections of the television signal producing "ghost" images on the kinescope. Diathermy machines located in the immediate neighborhood generally produce "snowstorms," and the close proximity of high-voltage transmission lines may also interfere with picture reproduction. The installation engineer will take all these things into consideration and will decide the best location for the antenna and whether or not shields and wave traps are necessary. Once properly installed, the television receiver is dialed like an ordinary radio set.

When the F.C.C. decides enough sets have been sold to make the broadcasting of television programs a profitable commercial venture for an advertiser, commercial licenses will be issued. The advertiser is then faced with a new and untried problem. What is to be the type and length of his commercial announcement.

Experience gained through radio will be of little avail. In radio there are several schools of thought regarding commercial announcements. Some advertisers believe that without frequent mention of the brand name, interrupting the program, the listener will not know whom to thank with sales for the pleasure of the show. Others feel that without good forceful product selling the time purchased is so much waste air space, and in their zeal make their commercial announcements so long that the public tunes out; others are content with a short commercial announcement at the beginning and the end of the program; others omit the commercials altogether and merely mention the company or corporation sponsoring the production.

In television it is quite doubtful if the audience sitting in a semi-darkened room and giving its undivided attention to the screen will tolerate interruptions in the program. A long and tedious explanation of the product will be unnecessary, because the actual motor car, the delicious package of dessert or the glamorous tooth-paste will be shown to the customer.

Let us suppose, for example, an advertiser has just sponsored a sparkling comedy and the audience is tempestuously applauding for more. If into this highly appreciative atmosphere a banal commercial is interjected it will undo every bit of the enthusiasm. The answer is that the commercial announcement must be every whit as sparkling as the comedy which

has just been broadcast so that, in the language of the stage, it will succeed in "topping the gag." This may be hard to do when one considers that the come-and-buy-now announcements are usually written by someone, without stage experience, in the employ either of the sponsor or the advertising agency. It is a fetish that no radio script writer can ever pen commercials that will meet with the sponsor's approval. The best examples of cleverly integrated radio announcements were those of Boake Carter for the Philco Radio and Television Company, and Ed Wynn's "Gags and Toppers" for Texaco, which were done in dialogue form with Graham McNamee.

If it is neither practical nor feasible for commercial announcements to be written in a gay sparkling vein, then the next best thing would be to have the announcement precede the actual program, with the sincere hope that the program would so stimulate the beholders that in gratitude they would buy the sponsor's product. Sponsors have been so interested in their own product that they have become quite unconscious of the fact that the customer may not share the same enthusiasm. Repetition has often wearied the audience and instead of acting as an incentive to purchase has created a feeling of antagonism.

Those of us who remember the days when there was no radio entertainment have been so grateful for these free programs that we accept the commercial even though sometimes it is long winded and irri-

tating. But there is a group graduating from high school this year who do not remember the time when they did not do their home work to the obbligato of the radio playing in the next room. Before the form of the television commercial becomes crystallized sponsors would do well to talk to these coming purchasers in the world of tomorrow and learn at first hand the cynicism that exists regarding overly advertised products.

As soon as the Federal Communications Commission lets down the bars to commercial programs those companies who have already applied for time will go on the air. But what about the corporation that feels that it cannot afford to sponsor both a television and a radio program? In view of the limited coverage afforded by television, it would not be sound business for the advertiser to divert his whole radio appropriation to this new medium. This company might cooperate with others in the same industry. The industry as a whole would benefit and each individual participant could expect to experience a proportionate increase in sales. Of course, under such a plan it might be argued that the little fellow who is not in a position to contribute at all—or at the most a comparatively modest proportion—would derive as much benefit as his biggest competitor. This is in a sense true, but during the development of any new advertising medium, there must be some altruism and less "dog eat dog" attitude. Those industries which specialize

in personalized selling through demonstration might take the lead in such a plan. The outstanding leaders in this class are first the automobile industry, followed closely by manufacturers of electrical appliances and, third, by makers of packaged foods.

When the whole family is assembled around the television receiver after dinner, what better means could the car manufacturer find to tell his story?

His car is rolled before the television camera and he has a golden opportunity to demonstrate its good points to an undistracted, receptive audience sitting at home in easy chairs. From that vantage point they can "Look at all three!" If the manufacturer cannot intrigue them sufficiently so that they will come later into the local showroom for a demonstration ride then there is something definitely the matter either with his product or his showmanship. Tire makers would have an unexampled opportunity to show why their tires are non-skid and to demonstrate visually the hidden values. Which brings up the point that all makers of accessories such as horns, lights, bumpers, wind-shield wipers, cigar lighters, batteries, shock absorbers and upholstery could take advantage of this new way of enlightening the public regarding the inherent worth of their product. The cost of participation in such a series of programs devoted exclusively to the automotive industry could be worked out on a pro-rata basis.

Any new device for saving manual labor in the household or making greater leisure possible for the homemaker is bound to find an ever increasingly responsive market. Time for demonstration for electrical or other household appliances might be taken by the public utilities. Washing machines, mechanical refrigerators, vacuum cleaners, stoves—with television it is possible to portray the actual use by live people of these products in the home. Every large radio station in the country has a model kitchen from which household programs are broadcast. Using this kitchen as a stage set all manner of time and labor-saving gadgets can be demonstrated.

With sight added to sound the packaged food people are in for a field day. Poor cooks, we hope, will be relegated to the past. Not only will the housewife be told why a certain flour should be used but she will be shown the actual technique of using it in making the cake. Cookbooks will come to life before our eyes as world famous chefs demonstrate the preparation of their choicest recipes.

Department stores which depend largely on arousing immediate consumer interest to create sales may find enormous merchandising possibilities in television. Bloomingdale's, in New York City, has used wired television between floors to give shopping information and to show merchandise that was being featured that day. The time may come when the busy

housewife making up her shopping list, will turn first to her kinescope to see what bargains the various shops are offering.

Television adds an infinite number of new arrows to the sales executive's quiver.

X. WHITHER TELEVISON?

It seems particularly fitting that television's debut should have been made at the New York World's Fair—for fairs in America have ever been the means of launching new inventions looking toward a better way of life. Mr. Edison's electric filament lamp was first introduced to the public at the Columbian Exposition at Chicago in 1893, Mr. Durant's automobile wheezed and snorted at the Louisiana-Purchase Exposition at St. Louis in 1904, the marvels of wireless telegraphy were exhibited at the Panama-Pacific International Exposition in 1915, and radio broadcasting was an accomplished fact at the Sesqui-Centennial Exposition in Philadelphia in 1926.

A successful television demonstration was given, however, as far back as 1928. In that year "The Queen's Messenger" was telecast from WGY, the General Electric Company's studio in Schenectady, N. Y. In 1930 a complete television program was telecast from WGY, received in Proctor's Theater on the opposite side of the city, and shown to a distinguished group, which included many electrical scientists and physicists.

Across the Mohawk River from Schenectady nestles the little town of Scotia, settled as its name implies by a hardy race of bra' Scots from the Hie'lands. The descendants of the original settlers keep up many of the traditions of their forebears—with the haggis always served on St. Andrew's Day.

When King George VI and Queen Elizabeth (the wee smilin' lassie fra' Glamis) visited the New York World's Fair, they were televised as they came out of the Federal Building. Both walked right up to within a few feet of the television camera and spoke brief greetings to the unseen audience. Little did they realize that they were being roundly cheered by a group of Americans of Scotch descent, standing bareheaded atop the Hie' lands of the Hudson, who had watched and heard every word through the miracle of television.

Schenectady is approximately 130 air miles distant from the Empire State Tower. Yet this was not the first time that the General Electric Company's engineers had picked up a New York City broadcast of a television program. They have not been able to get the telecast from the Empire Tower at all times, nor can they explain why they do get both sight and sound so clearly, when, theoretically, the television wave can be controlled only to the optical horizon, from which it travels into unknown space. At Southampton, Long Island, experimental receiving sets have received occasional faint images from England but these were unaccompanied by any sound. In Arizona, similar

strange telecasts from overseas have been seen. One explanation of the engineers is that when a very cold layer of air lies over a very warm layer the two become a camera lens which returns the televised image to the earth. This is one of the major problems occupying the attention of the scientists, because the solving of it may take care of two other problems: one, how to telecast over a national network and, two, how to keep television stations from interfering with each other.

A license has been granted to the General Electric Company to build in the Helderberg Mountains, about twelve miles from Schenectady, one of the most powerful television stations in the country. The summit is known locally as Indian Ladder and is at the top of a 1,500 foot cliff. Mounted on 100 foot towers, the antenna sends out a television signal of 10 kilowatts, sufficient to reach Albany, Troy, Schenectady as well as the smaller cities of Saratoga and Amsterdam. The total population of this fan-shaped area is estimated at slightly over 500,000. Because it is not located on the highest point of the Helderbergs—there are several higher peaks that rise to the south and east—the station will be screened from the Empire State Tower in New York City. This station is to be used for commercial programs as soon as such licenses are issued. In Bridgeport, Connecticut, the General Electric Company has established an experimental station to be used for testing the strength and quality of the tele-

vision signal, hence programs will be telecast irregularly.

The Du Mont Laboratories, one of the largest independent makers of cathode-ray vacuum tubes in this country operates an experimental telecasting station at Passaic, New Jersey, and has applied for a license for a station in Washington, D. C. Philco Radio and Television Corporation has been licensed to telecast from Philadelphia. Farnsworth Television Inc., is operating an experimental television station at Springfield, Pennsylvania. The Zenith Radio Corporation has a license and is experimenting in Chicago. The Crossley Radio Corporation of Cincinnati, Ohio, is building a television studio in Carew Tower, 574 feet above the street level. As soon as the application for a license is approved, daily telecasts will be inaugurated using both live talent and films. Experiments from Carew Tower have proved that it is high enough to telecast the signal to Cincinnati's suburban district which lies beyond seven encircling hills.

Outside of the radio industry, several universities and colleges have received licenses. Among them are the University of Iowa, situated at Iowa City, Purdue University at West Lafayette, Indiana, and the Kansas State College of Agriculture and Applied Science at Manhattan, Kansas. One enterprising newspaper, the Milwaukee *Journal*, of Milwaukee, Wisconsin, has applied for a license. Another application has come from the LeRoy jewelers in Los Angeles.

This appears to be an impressive list but for the next year or even two the public cannot expect regular television programs except in the New York and California areas. There are too many economic and financial problems which must be solved before these experimental stations will be ready to do an adequate commercial job even though licensed. There has been so much publicity regarding television that the nation has expected it to be born full grown. It must be remembered that it is a baby industry, a lusty infant if you will, whose future is golden with promise.

Until the scientists solve the riddle of the optical horizon there are less than 100 localities of sufficient population to guarantee an advertiser a profitable return from sponsoring a television program. More and more money must be spent by the broadcasting companies before any gain can be expected from their already large investments. For one thing, the present television studios of both the National Broadcasting Company and the Columbia Broadcasting System are too small to televise programs more than two or three hours daily. Unlike radio, all rehearsals must be held in the actual studio from which they are telecast. When production reaches a greater number of hours it will be necessary to build studios along the same lines as the motion picture lot. The Don Lee System has already prepared for this emergency. They have purchased the old Mack Sennett estate of twenty acres

which is situated on a mountain 1,700 feet above the city of Los Angeles.

A national survey made by the Institute of Public Opinion showed that 4,000,000 families considered themselves likely prospects as television set purchasers when their areas receive regular programs. This potential American market has appealed to others besides ourselves. Recently there has been a large number of visiting foreigners looking into the various phases of television's progress in America. The Baird Television Company of England expects to introduce television into American moving picture theaters.

Whenever people write or speak of television, the radio and the motion picture are the two industries with which it is most frequently compared. But neither one is a wholly satisfactory comparison because television is a new art, a new means of communication and above all a brand new industry, whose problems are unique and are far from being understood or even imagined.

Undoubtedly there will be a great deal of money made and lost in television during the next ten years. There will be mushroom companies which will spring up overnight and, trading on the good-will established by the reputable corporations who have been pioneers in the field, will attempt to sell television securities to the always gullible American public. The Chambers of Commerce and the Securities Exchange Commission are exercising more than usual caution in exam-

ining the financial standing of new television corporations. There has been a flurry or two in television securities and trade papers are already carrying the advertising of television stock specialists.

Television has been hailed as being brought out of the laboratory and into the home, but that does not mean that research has been stopped. On the contrary, it has been intensified. The receiver itself will remain practically as it is for some time to come, but how to bring more and finer pictures from longer distances to that receiver, occupies the thought of hundreds of scientists.

The Bell Telephone Laboratories have been experimenting with ordinary telephone wires which they prepared specially for television use. During the 1939 Six Day Bicycle Races in Madison Square Garden in New York City, this television circuit was used, instead of the coaxial cable, to transmit the telecast from the Garden to the Empire State Tower a distance of a mile and a half. The Laboratories are now experimenting with the possibility of using this method for longer distances. If this can be done the cost of transmitting television will be reduced materially.

The Radio Corporation of America is studying the practicality of placing automatic radio relay stations twenty miles apart as another means of establishing a television network.

Whither television?

No one really knows. The public looks upon it as an entertainment medium. Everyone who wishes to reach that public, be he salesman, politician or teacher, rejoices in a new way to do it. But there are other uses beyond entertainment, beyond propaganda and beyond education. Television becomes both an instrument of war and an instrument of peace. The year 1939 saw the Intelligence Division of the United States Army give official recognition to television and use it as an integral unit of G-2. In times of actual warfare staffs of both armies could know accurately what was transpiring at the front, unless some way was devised of interfering with the television transmission of the enemy.

When television spans the oceans the frontiers of the world will shrink once more. The airplane and the radio have introduced us to the man on the other side of the sea; when, with television, we both meet face to face we shall be friends. Perhaps then it will be more difficult for the war lords to drum up the old hates and fears which have depended for their life on ignorance, distance and isolation.

Mr. Sarnoff says, "With the advent of television a new force is being given to the world. Who can tell what the power to extend vision will mean ultimately in the stream of human life? . . . The ultimate contribution of television will be its service toward unification of the life of the nation and at the same time a greater development of the life of the individual.

We who have labored in the creation of this promising new instrumentality are proud to launch it upon its way, and hope that through its proper use America will rise to new heights as a nation of free people and high ideals."

APPENDIX A

FCC REGULATIONS APPLICABLE TO TELEVISION BROADCASTING STATIONS

DEFINITION

THE term "visual broadcast service" means a service rendered by stations broadcasting images for general public reception. There are two classes of stations recognized in the visual broadcast service, namely: television broadcast stations and facsimile broadcast stations. The term "television broadcast station" means a station licensed for the transmission of transient visual images of moving or fixed objects for simultaneous reception and reproduction by the general public. The transmission of synchronized sound (aural broadcast) is considered an essential phase of television broadcast and one license will authorize both visual and aural broadcast.

LICENSE REQUIREMENTS

A license for a television broadcast station will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and experimentation which indicates reasonable promise of substantial contribution to the development of the television broadcast art.

2. That the program of research and experimentation will be conducted by qualified engineers.

3. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program.

4. That the public interest, convenience and/or necessity will be served through the operation of the proposed station.

RESTRICTIONS IN OPERATION

A licensee of a television broadcast station shall not make any charge, directly or indirectly, for the transmission of either aural or visual programs.

In the case of experimental televising of the production of a commercial standard broadcast program, all commercial announcements not a part of the entertainment continuity shall be eliminated from the television broadcast except the mere statement of the name of the sponsor or product or the televising of the trademark, symbol, slogan or product of the sponsor; provided, however, that when the program transmission is incidental to the experiments being conducted and not featured, and subject to interruptions as the experiments may require, the commercial announcement may be broadcast aurally.

No licensee of a standard broadcast station or network shall make any additional charge, directly or indirectly, for the simultaneous transmission of the aural or visual program by a television broadcast station, nor shall commercial accounts be solicited by the licensee of a standard broadcast station or network, or by others acting in their behalf upon the representation that the commercial program will also be transmitted by a television broadcast station.

The synchronized sound (aural) program of a television broadcast station may be broadcast by a standard broadcast station, provided:

1. That no announcements or references shall be made over the standard broadcast station regarding the operation of the television broadcast station, except the mere statement that the program being transmitted is the sound or

aural program of a television broadcast station (identify by call letters).

2. That the call letter designation when identifying the television broadcast station shall be given on its assigned frequency only.

Each television station will be assigned only one 6000-kilocycle frequency band from groups in the above regulation. Both aural and visual carriers with side bands for modulation are authorized but no emission shall result outside the authorized frequency band.

Frequency band in Group A shall be used by stations principally for developing television intended directly for public reception. Frequency bands in Groups B and C may be licensed for the same purposes as those in Group A and, in addition, for stations to serve auxiliary television purposes such as television relay stations, developmental mobile service. However, no mobile or portable station will be licensed for the purpose of transmitting television programs to the public directly.

A licensee will not be granted a second television to operate on a frequency band in Group A which would serve in whole or part the same service area as already served by a station licensed to it for a frequency band in Group A.

POWER LIMITATIONS

The operating power of a television broadcast station shall not be in excess of that necessary to carry forward the program of research. The operating power may be maintained at the maximum rating or less, as the conditions of operation may require.

REPORT REQUIREMENTS

A supplemental report shall be filed with and made a part of each application for renewal of license and shall include statements of the following:

1. Number of hours operated for transmission of television programs.

2. Comprehensive report of research and experimentation conducted.

3. Conclusions and programs for further developments of the television broadcast service.

4. All developments and major changes in equipment.

5. Any other pertinent developments.

APPENDIX B

GLOSSARY OF TELEVISION TERMS

AUDIO (*Latin, "I hear"*)—Pertaining to the transmission of sound.

BLIZZARD HEAD—A blonde actress, to studio technicians who have to worry about proper lighting for her hair to avoid flares.

BROAD—A general illumination unit used in lighting the set.

BUSINESS—Anything in television for which a technical designation is lacking or forgotten by the speaker. Badly overworked.

CATHODE-RAY TUBE—Evacuated funnel-shaped tube containing the screen on which the picture is reproduced in the receiver.

COAXIAL CABLE—Special telephone cable suitable for conveying television signals.

CONTRAST CONTROL—A knob on the receiver for adjusting the range of brightness between highlights and shadows in a picture.

FOCUSING CONTROL—A knob on the receiver for bringing the picture into sharpest definition.

FRAME—One complete picture. Thirty of these are shown in one second on a television screen.

FRAMING CONTROL—A knob or knobs on the receiver for centering and adjusting the height and width of pictures.

GHOST—An unwanted image appearing in a television picture as a result of signal reflection.

GOBO—A light-deflecting fin used to direct light in the studio and protect the camera lens from glare.

HOT LIGHT—A concentrated light used in the studio for emphasizing features and bringing out contours.

ICONOSCOPE—A type of television camera tube used by RCA but on which Westinghouse Electric & Mfg. Co. claims patent control under a recent court decision.

IMAGE DISSECTOR—A type of camera tube developed by Farnsworth.

INTERLACING—A technique of dividing each picture into two sets of lines to eliminate flicker.

KINESCOPE—A receiving cathode-ray tube developed by RCA.

LINE—A single line across a picture, containing high-lights, shadow, and half-tones; 441 lines make a complete picture.

LIVE TALENT—Participants in a program picked up directly in the studio, as distinguished from film presentations.

PANNING—A horizontal sweep of the camera. (From "panorama.")

SAWTOOTH—A wave of electric current or voltage employed in scanning.

SCANNING—The action of the electron beam in exploring (in the camera tube) or reproducing (in the cathode-ray tube) the half-tones in a picture.

SCOOPS—Multiple lighting units in the studio.

SPOT—The visible spot of light formed by the impact of the electron beam on the screen as it scans the picture.

SYNCHRONIZATION—The process of maintaining synchronism between the scanning motions of the electron beams in the camera tube and the cathode-ray tube in the receiver.

TELECAST—A television broadcast.

TELECINE TRANSMISSION—A movie program.

TELEVISION—The transmission and reproduction of transient visual images by radio.

TILTING—A vertical sweep of the camera.

VIDEO (*Latin, "I see"*)—Pertaining to the transmission of transient visual images (cf. "audio").

WINDSHIELD—A perforated metal cover which fits over the microphone and protects it from drafts caused by the powerful air conditioning system used to remove heat caused by the lights in the studio.

WOMP—A sudden surge in the signal strength resulting in a flare-up of light in the picture.

(Reprinted through the Courtesy of *Business Week.*)

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